2.0 HUNTERS POINT SHIPYARD AND PARCEL D SITE HISTORY AND CHARACTERIZATION

The Navy acquired HPS in 1939. The main portion of HPS is situated on a long promontory in the southeastern part of San Francisco, extending eastward into the Bay (see Figure 1-1). The property at HPS consists of 866 acres, 420 on land, and 446 off shore.

Parcel D was originally 128 acres in the southeast-central portion of HPS and consisted of 27 IR sites that were investigated during the initial RI. In 1997, IR-36 was transferred from Parcel D to Parcel E, reducing the area of Parcel D to 101 acres. In March 2004, a portion of Parcel A was transferred to Parcel D. In February 2005, the Navy redefined the boundary of Parcel D to exclude sites IR-08, IR-38, and IR-39, reducing Parcel D by an additional 3 acres to its current 98 acres (see Figure 2-1).

Parcel D currently contains all or portions of 23 IR sites. Twenty IR sites are located entirely within Parcel D: IR-09, IR-16, IR-17, IR-22, IR-32, IR-33 North and South, IR-34, IR-35, IR-37, IR-44, IR-48, IR-53, IR-55, IR-65, IR-66, IR-67, IR-68, IR-69, IR-70, and IR-71. Portions of sites IR-45 (steam line system) and IR-50 (storm drain and sanitary sewer system) are also within Parcel D because they are facility-wide utility sites that traverse several parcels. Site IR-51 is also a facility-wide site that consists of buildings and areas that formerly housed electrical transformers, including locations within Parcel D.

This section presents information on the site history and characterization of HPS and Parcel D that is relevant to the evaluation in the FS. Section 2.1 discusses the history of HPS. Section 2.2 discusses the setting of HPS and Parcel D, including land use, historic areas, climate, topography and surface water drainage, ecology, soils, geology, and hydrogeology. Section 2.3 summarizes past investigations, and Section 2.4 summarizes removal actions completed at Parcel D. Section 2.5 presents the nature and extent of the environmental chemicals of interest in soil and groundwater at Parcel D.

2.1 HPS HISTORY

The promontory where HPS is located has been recorded in maritime history since 1776, first as Spanish mission lands used for cattle grazing, and later as a dry dock in the 1840s. In 1939, the U.S. government received title to the land at Hunters Point and began developing it as a shipyard. Originally a deepwater, two dry dock facility when it was purchased, the Navy augmented HPS to a full-service ship repair and maintenance facility with numerous support buildings, an internal railroad, and living quarters. To support the expansion, the Navy quarried the nearby cliffs to create a working pad 12 to 15 feet above mean sea level by filling the Bay with quarried material (Navy 2004). The filled areas were supported by concrete seawalls along the waterfront. From 1945 to 1974, the Navy used HPS predominantly as a repair facility. Additional acreage, mostly on the south side of the base, was acquired in 1957. The Navy operated the shipyard as a ship repair facility through the late 1960s. HPS was also the site of the Naval Radiological Defense Laboratory.

In 1974, the Navy ceased shipyard operations at HPS and transferred control of the property to its Office of the Supervisor of Shipbuilding, Conversion, and Repair in San Francisco. The shipyard remained relatively unused until 1976. From 1976 to 1986, the Navy leased 98 percent of HPS to a private ship repair company, Triple A Machine Shop, Inc. (Triple A). Triple A leased the property from July 1, 1976, through June 30, 1986; however, Triple A did not vacate the property until March 1987. During the lease period, Triple A used dry docks, berths, machine shops, power plants, offices, and warehouses to repair commercial and naval vessels. Triple A also subleased portions of the property to other businesses.

In 1987, the Navy resumed occupancy of HPS. Many of the subtenants under Triple A's lease remained as Navy tenants, including those using facilities for maritime, industrial, and artistic purposes. From November 1985 to August 1989, several Navy surface ships were docked at the shipyard.

Because hazardous materials from past shipyard operations had been released into the environment, HPS was included on the National Priorities List in 1989 as a Superfund site pursuant to CERCLA as amended by the Superfund Amendments and Reauthorization Act of 1986. In 1991, HPS was slated for closure under the Defense Base Closure and Realignment Act of 1990. HPS was designated as a "B" site by the Agency for Toxic Substances and Disease Registry (ATSDR) in 1991, which meant that ATSDR determined that HPS posed no imminent threats to human health but had the potential to pose long-term threats to human health (ATSDR 1991). On April 1, 1994, the HPS mission as a shipyard officially ended under the Defense Base Closure and Realignment Act of 1990.

The Naval Facilities Engineering Command, Engineering Field Activities West, in San Bruno, California, had initial oversight of the base closure management. After closure of Engineering Field Activity West in 2000, the oversight authority was transferred to the Naval Facilities Engineering Command, Southwest Division, in San Diego, California. Ongoing work at HPS is currently overseen by BRAC Program Management Office West, in San Diego, California.

2.2 HPS AND PARCEL D SETTING

The following subsections summarize the setting of HPS and Parcel D, including (1) land use, (2) historic areas, (3) climate, (4) topography and surface water drainage, (5) ecology, (6) soils, (7) geology, (8) hydrogeology, and (9) groundwater beneficial use. A detailed description of the HPS setting is presented in Section 3.0 of the draft final Parcel D RI report (PRC, LFR, and U&A 1996). Detailed updates on the geology and hydrogeology of Parcel D are also provided in the Phase II and III groundwater data gaps investigation (GDGI) reports (Tetra Tech EM Inc. [Tetra Tech] 2001b, 2003a).

2.2.1 HPS, Surrounding Area, and Parcel D Land Use

The Bayview/Hunters Point district of San Francisco bounds the HPS promontory on the north and west, and the Bay borders HPS on the south and east. The Bayview/Hunters Point district is

a low-density demographic area where about half the residents own their homes. More than half of the land in the San Francisco Bayview/Hunters Point district is used for industrial purposes.

The land at HPS was formerly divided into three distinct functional areas: (1) the industrial production area, which consisted of the waterfront and shop facilities for the structural machinery, electrical, and HPS service groups; (2) the industrial support area, which consisted of supply and public works facilities; and (3) the nonindustrial area, which consists of former residential facilities for Navy personnel, recreational areas, and a restaurant.

Parcel D is bounded by other portions of HPS and by the Bay. Most land at Parcel D was formerly part of the industrial support area and was used for shipping, ship repair, and office and commercial activities. Portions of Parcel D were also used by the Naval Radiological Defense Laboratory (NRDL). The docks at Parcel D were formerly part of the industrial production area. The historical and current uses of buildings at Parcel D are summarized in Table 2-1. This table also includes the radiological contamination potential at these buildings or building sites, as listed in the Historical Radiological Assessment (Radiological Affairs Support Office [RASO] 2004). According to the Redevelopment Plan (San Francisco Redevelopment Agency 1997), Parcel D will be zoned for the following reuses: educational and cultural, mixed uses, research and development, open space, industrial, and maritime industrial. The proposed reuse areas are shown on Figure ES-1.

2.2.2 Parcel D Historic Areas

The 450-ton bridge crane at the Regunning Pier (IR-32) is the only structure in Parcel D with the potential for inclusion on the National Register of Historic Places (PRC, LFR, and U&A 1996). As a result, any proposed remedial action performed at IR-32 will comply with the substantive requirements of the National Historic Preservation Act.

2.2.3 Parcel D Climate

The climate in the HPS area is characterized by partly cloudy, cool summers with little precipitation and mostly clear, mild winters with moderate precipitation. The prevailing wind direction is west to east (Brown and Caldwell 1995). The average wind speed is 10 miles per hour, and the usual maximum wind speed is 20 miles per hour. Normal annual rainfall in San Francisco, as monitored at the San Francisco Federal Building, is 20 inches (National Oceanic and Atmospheric Administration [NOAA] 2005).

2.2.4 Parcel D Topography and Surface Water Drainage

More than 80 percent of HPS consists of relatively level lowlands, which was mostly constructed by placing borrowed fill material from the surrounding hills along the margin of the Bay. Nearly 100 percent of Parcel D is located in the lowlands, with surface elevations between 0 to 10 feet above mean sea level. Figure 2-2 shows ground surface elevation contours for Parcel D.

Storm water surface runoff at HPS drains primarily in a sheet-flow pattern from the highlands north and west of Parcel D to the surrounding lowlands. Runoff in Parcel D is collected by the storm drain system and discharged through outfalls to the Bay. The storm drain system at HPS consists of 10 major drainage areas. Five of these storm water drainage areas are located completely or partially within Parcel D. In addition, eight smaller isolated drainage areas are located in Parcel D, each with an independent outfall (PRC, LFR, and U&A 1996). Approximately 10 percent of the HPS surface is not served by the storm drain system, including the undeveloped shoreline, some pier areas, and a trailer parking lot. No naturally occurring drainage channels remain at HPS. Pre-existing drainage channels were filled in or modified by construction over the years. The location and distribution of the storm drain and sanitary sewer lines at Parcel D are presented on Figure 2-3. The Navy has begun to remove the storm drain and sanitary sewer lines throughout Parcel D; completion is planned for 2008.

2.2.5 Parcel D Ecology

Several hundred types of plants and animals are believed to live at or near HPS, including terrestrial and marine plants and algae; benthic and water column-dwelling marine animals such as clams, mussels, amphipods, and fish; insects; amphibians; reptiles; birds; and mammals. No threatened or endangered species are known to inhabit HPS or its vicinity (Environmental Science Associates 1987). Parcel D ecology is limited to those plant and animal species adapted to the industrial environment. For example, the 450-ton bridge crane could provide nesting locations for peregrine falcons, which would also prey on smaller birds (RASO 2004). Viable terrestrial habitat is inhibited at Parcel D because approximately 85 percent of the ground surface is covered by pavement and industrial buildings. Physical structures at Parcel D, such as docks and piers, may serve as artificial habitats for estuarine life.

In the spring of 2004, an individual burrowing owl (*Athene cunicularia*) was sighted at Parcel D. Burrowing owls are listed as "Species of Special Concern" by the California Department of Fish and Game (2004). Species of special concern status applies to animals not listed under the federal or state Endangered Species Act, but which nonetheless are declining at a rate that could result in listing, or have historically occurred in low numbers and known threats to their persistence currently exist.

The burrowing owl was identified prior to implementing a time-critical removal action (TCRA) for removing stockpiled soil at Parcel D (see Section 2.4). The owl's burrow was observed on the ground in the area of the soil stockpiles and was not within the stockpiled soil. Appropriate measures were taken during the field activities for the TCRA to minimize the impacts to the burrowing owl's habitat (Tetra Tech 2004; Navy 2004).

In March 2005, the Navy surveyed Parcel D and determined that a burrowing owl was present at the site. The Navy decided that the burrowing owl would be relocated because excavation and removals were planned for the summer of 2005 at the adjacent Parcel E and because future remediation of Parcel D could include remedies that potentially could affect the owl.

As a result, in April 2005, the owl was relocated off Parcel D using a passive relocation method. Passive relocation involves installing a one-way door in the burrows, so that the owl can leave but not reenter, and collapsing the burrows 48 hours after the door is in place. The Navy consulted with Peter Bloom of the California Department of Fish and Game to conduct this passive relocation project in accordance with California Department of Fish and Game guidelines.

No other potential terrestrial receptors or habitat have been identified at Parcel D. It is unlikely that Parcel D will contain terrestrial habitat in the future because its proposed reuse is primarily industrial.

2.2.6 Parcel D Soils

Soils at HPS are either the result of (1) weathered material from nearby rock formations and sediments from the Bay or (2) imported fill material placed at HPS during its development. The area northwest of Parcel D is primarily covered by upland soils, which are moderate to steeply sloped terrains. Parcel D is primarily lowland soils, which are flat to gently sloped urban developed lands. These lowland soils are susceptible to subsidence by natural compaction or during moderate to strong earthquakes. Soils at HPS are described in detail in Appendix H of the draft final Parcel D RI report (PRC, LFR, and U&A 1996). Figure 2-4 shows the distribution of soils at HPS.

2.2.7 Parcel D Geology

The peninsula forming HPS is within a northwest-trending belt of Franciscan Complex bedrock known as the Hunters Point Shear Zone. In some locations, the Marin Headlands Terrane underlies this shear zone. HPS is underlain by five geologic units, the youngest of Quaternary age, and the oldest, the Franciscan Complex bedrock, of Jurassic-Cretaceous age. In general, the stratigraphic sequence of these geologic units, from youngest (shallowest) to oldest (deepest), is as follows: Artificial Fill; Undifferentiated Upper Sand Deposits; Bay Mud Deposits; Undifferentiated Sedimentary Deposits; and Franciscan Complex Bedrock. The locations of the fill material, the colluvium, alluvium and landslide debris, and the chert, shale, sandstone, volcanic, and serpentine bedrock units at HPS are shown on Figure 2-5.

The Navy believes that the practice of using quarried local rock for fill at HPS is similar to construction practices in the same bedrock formations used elsewhere in San Francisco. The Navy observed that a wide range of concentrations of metals are found in similar chert, basalt, and serpentinite bedrock formations in other areas of San Francisco based on sampling that the Navy conducted in 2003 at areas outside of HPS. This information is summarized in a report titled "Draft Metals Concentrations in Franciscan Bedrock Outcrops" (Tetra Tech and Innovative Technical Solutions, Inc. [ITSI] 2004).

In the Tetra Tech and ITSI 2004 report, the Navy studied the ambient concentrations of metals in bedrock and bedrock-derived soil from three nonindustrial sites in San Francisco. These three sites have a similar geologic setting to HPS and contain serpentinite or chert and basalt bedrock

typical of the Franciscan Complex. The sites included the two Franciscan Complex subunits that form the HPS peninsula: the Hunters Point Shear Zone and the Marin Headlands Terrane. The investigation included about 30 rock and soil samples from each of the three sites (91 samples total) that were analyzed for metals using a standard analytical suite of EPA methods. The study found elevated concentrations of arsenic, iron, and manganese associated with chert bedrock and elevated nickel concentrations associated with serpentinite. The chemical composition of soil at the three sites was found to be similar to the chemical composition of rock. Of the 91 samples collected, none met the cleanup standards for unrestricted residential reuse at HPS because of the elevated ambient concentrations of these metals in the serpentinite bedrock and its derived soils. Based on this study, the Navy believes that the elevated concentrations of metals in the soils at HPS as represented by the HPALs, is also a result of the ambient metals concentrations in a serpentinite sourced fill material.

The draft final Parcel D RI report presented cross sections (see Figures 3.7-10 through 3.7-15 of that report) that depict the relationship of the various geologic units at the site (PRC, LFR, and U&A 1996). The geologic interpretations presented in the cross sections were updated in the 2002 draft Parcel D revised D FS based on data collected during the Phases I and II GDGI (Tetra Tech 2001a, 2001b). The cross section location map and the updated cross sections are presented on Figures 2-6 and 2-7.

The following description of the geologic setting at Parcel D summarizes the information presented on the updated cross sections. The bedrock at Parcel D is mainly composed of serpentinite belonging to the Hunters Point Shear Zone of the Franciscan Complex (Tetra Tech 2001b). The depth to Franciscan Complex Bedrock from the ground surface in Parcel D varies from less than 1 foot in the northern area to more than 120 feet in the southeastern area. Undifferentiated Sedimentary Deposits overlie bedrock over much of Parcel D, occurring beneath Bay Mud Deposits or, rarely, directly beneath Artificial Fill; these deposits range up to 80 feet thick. Bay Mud Deposits underlie most (about 80 percent) of Parcel D, except for a strip along the northern margin of the site. Where present, Bay Mud Deposits are typically 20 to 30 feet thick and are thickest (up to 40 feet) beneath the southeastern part of the parcel. Undifferentiated Upper Sand Deposits are discontinuous beneath Parcel D. These deposits generally overlie Bay Mud, but may interfinger with Bay Mud Deposits and, in a few localities, directly overlie Undifferentiated Sedimentary Deposits. The Undifferentiated Upper Sand Deposits generally range from a few feet to up to 40 feet thick. Artificial Fill overlies all of the naturally occurring units and ranges from approximately 2 feet thick in the north to 40 feet thick in the middle of Parcel D. In most of Parcel D, the artificial fill ranges from 20 to 30 feet thick. The thickness of the Artificial Fill and all sedimentary deposits generally increases toward the Bay. Table 2-2 summarizes the geology at each IR site located within Parcel D.

2.2.8 Parcel D Hydrogeology

This section summarizes the hydrostratigraphic units, groundwater flow patterns, and hydraulic characteristics of the main hydrogeologic units. Detailed descriptions of the hydrogeology at Parcel D are presented in the RI (PRC, LFR, and U&A 1996; PRC and LFR 1997) and Phase II and III GDGI reports (Tetra Tech 2001b, 2003a).

2.2.8.1 Hydrostratigraphic Units

The hydrostratigraphic units at HPS are (1) the A-aquifer, (2) the aquitard, (3) the B-aquifer, and (4) the deep bedrock water-bearing zone. Cross sections presented on Figure 2-7 show the hydrostratigraphic units in different colors, except for the deep (fractured) bedrock water-bearing zone, which is shown in white. The shallow (weathered) bedrock water-bearing zone near the boundary between the non-Navy property to the north and Parcel D (shown on the left side of cross section A-A' on Figure 2-7) and at other locations is hydraulically connected with the A-aquifer and therefore is considered part of the A-aquifer in this location.

Shallow, unconfined groundwater occurs continuously across all of Parcel D in the A-aquifer. The A-aquifer at Parcel D consists mainly of unconsolidated artificial fill material that overlies the aquitard and bedrock. Undifferentiated Upper Sand is also part of the A-aquifer at some locations. Based on the cross sections shown on Figure 2-7, the A-aquifer consists mostly of sandy gravel and gravelly sand with limited zones of low-permeability sandy clay. Significant portions of the A-aquifer are also made up of less permeable fill. The A-aquifer typically ranges from 10 to 40 feet thick, but averages approximately 25 feet thick.

The aquitard is generally made up of silts and clays of the Bay Mud and Undifferentiated Sedimentary deposits. The aquitard ranges from 0 to 100 feet thick, but is most commonly 40 to 80 feet thick (see Figure 2-7). The aquitard is absent in the northern part of Parcel D where the A-aquifer is in direct contact with the bedrock and is thickest in the southeastern part of the parcel. The aquitard inhibits groundwater communication between the A-aquifer and the B-aquifer.

The B-aquifer is associated with the Undifferentiated Sedimentary deposits and consists of small, laterally discontinuous permeable sediment lenses of gravel, sand, silty sand, or clayey sand intermingled with the aquitard. The largest B-aquifer area is present near the center of Parcel D. The B-aquifer area at this location is estimated to be approximately 1,500 feet wide by 1,000 feet long, and is shown at its appropriate depth in cross sections A-A' and C-C' (see Figure 2-7). The B-aquifer varies from 20 to 30 feet thick. Groundwater in the discontinuous B-aquifer areas is under confined conditions. Table 2-2 summarizes the hydrogeologic units underlying each IR site.

2.2.8.2 Groundwater Flow Patterns and Tidal Effects

More than 85 percent of the ground surface at Parcel D is covered by pavement and buildings; as a result, most precipitation is channeled into the storm drain system. Unpaved areas may serve as localized vertical recharge areas. Leaking water lines also serve as limited sources of localized recharge. Base flow from the uplands north of Parcel D provides lateral groundwater recharge across the northern boundary of the parcel. Groundwater discharges directly to the Bay (1) along the shoreline, which is significantly modified by the presence of impermeable dry docks and sea walls in some areas, and (2) through permeable or semipermeable utility line corridors. In the past, groundwater that entered the sanitary sewer was discharged to the local publicly owned treatment works. Currently, the sanitary sewer system has been disconnected, and the sanitary sewers are being removed as part of a radiological removal action.

Groundwater flow patterns at Parcel D are complex because they are affected by (1) a groundwater sink located near the former western boundary of Parcel D (this area is now in Parcel E); (2) a groundwater mound located near the current western boundary of Parcel D (beneath IR-33, IR-44, IR-66, and IR-67); (3) leaks of groundwater into former sanitary sewers or storm drains; (4) recharge from water supply lines; and (5) tides in the Bay. Most groundwater at Parcel D flows toward the Bay, except in the western portion of Parcel D, which historically has flowed away from the mound and toward the groundwater sink in Parcel E (see Figure 2-8), where groundwater elevations are below mean sea level. The sink is believed to be caused by leaks of groundwater into sanitary sewer lines, which was then pumped off site to the local publicly owned treatment works, thereby lowering groundwater levels in the area. Flow patterns are anticipated to change as the sewer and storm drain lines are removed. Figure 2-9 shows the groundwater elevation contours from groundwater monitoring in March 2007.

The investigation of the bedrock underlying Parcel D has been limited and included areas where shallow bedrock and colluvium are hydraulically connected to the A-aquifer. In addition, the deep borings at Parcel D indicate the deeper bedrock underlying the Undifferentiated Sedimentary deposits consists mostly of fractured and moderately to strongly weathered serpentinite. Direct vertical hydraulic communication between the A-aquifer and the B-aquifer is inhibited because of the thick aquitard that separates them (see Figure 2-7). In addition, an upward vertical hydraulic gradient was observed at most well pairs installed at Parcel D (Tetra Tech 2004). Therefore, at Parcel D, migration of groundwater from the A-aquifer to the B-aquifer is considered minimal.

Tidal influence is the periodic fluctuation in the elevation of the groundwater table with time, caused by tide fluctuations in the Bay. Tidal influence may also include mixing or diluting groundwater with bay water, but the mixing usually does not occur as far inland as the fluctuations in groundwater elevation. The tidal influence zone is defined as the area where the maximum tidal fluctuation (difference in groundwater elevation between consecutive high and low tides) exceeds 0.10 foot. Based on tidal influence studies conducted during the RI (PRC, LFR, and U&A 1996) and the phase III GDGI (Tetra Tech 2003a), the tidal influence zone extends inland up to about 500 feet. Storm drains and utility corridors that are submerged below the water table could locally increase the magnitude of the tidal influence and the distance inland that is affected. Figure 2-3 shows the storm and sanitary sewer utility lines that are below the water table. The storm and sanitary sewer utility lines at Parcel D are scheduled for removal during 2007 and 2008.

2.2.8.3 Hydraulic Characteristics

The hydraulic conductivity of the A-aquifer at Parcel D typically ranges from 1 to 21 feet per day. The hydraulic conductivity was estimated based on data from slug and pumping tests performed during the RI (PRC, LFR, and U&A 1996). The minimum and maximum reported hydraulic conductivity values for IR sites located within Parcel D are 0.025 and 580 feet per day. The wide range of reported hydraulic conductivities indicates that the aquifer matrix is very

heterogeneous. The A-aquifer consists primarily of heterogeneous artificial fill materials that vary from clay to silt to sand to gravel.

The estimated groundwater velocities at Parcel D range from 1.5 to 31 feet per year. These velocities were calculated using the typical intermediate value of hydraulic gradient for the A-aquifer throughout Parcel D of 0.001 (PRC, LFR, and U&A 1996) and an assumed effective porosity for the A-aquifer of 0.25. No slug test or pumping test evaluations were performed for the B-aquifer within Parcel D. However, slug tests were performed in two monitoring wells in the underlying fractured bedrock water-bearing zone at IR-09 in the north-central area of Parcel D (PRC, LFR, and U&A 1996), with estimated hydraulic conductivities ranging from 0.025 to 3.7 feet per day. In general, groundwater velocities in the fractured bedrock water-bearing zone is expected to be low because the flow occurs mostly through fractures that are likely filled with residual clays and silts (PRC, LFR, and U&A 1996).

2.2.9 Groundwater Beneficial Use Evaluation

This section summarizes the beneficial use evaluation conducted for groundwater underlying Parcel D. The complete beneficial use evaluation is presented in Appendix D. The potential beneficial uses of Parcel D groundwater have been evaluated several times in the past (see Appendix D; Tetra Tech 2001c). In 2003, the Navy concluded that A-aquifer groundwater at Parcel D is unsuitable for use as a potential source of drinking water based on an evaluation of site-specific factors (Navy 2003). In 2003, the Water Board concurred with the Navy's determination that the A-aquifer at HPS is not a potential drinking water source (Water Board 2003). EPA, however, did not concur and required that federal criteria also be used to assess if Parcel D groundwater could be considered a potential drinking water source.

EPA considers groundwater to be a potential source of drinking water if the following criteria are met:

- The total dissolved solids (TDS) concentration is less than 10,000 milligrams per liter (mg/L)
- A minimum well yield of 150 gallons per day or 0.104 gallon per minute can be achieved

Figure 2-10 presents the maximum TDS concentrations detected in A-aquifer groundwater monitoring wells at Parcel D. As shown on Figure 2-10, TDS concentrations exceed 10,000 mg/L along the Parcel D shoreline and are less than 10,000 mg/L in the central and northwestern part of the parcel. The federal TDS criterion was applied separately to each IR site at Parcel D in this FS report. Based on this criterion, groundwater underlying all or part of the following 17 IR sites could be considered potential sources of drinking water: IR-09, IR-16, IR-17, IR-32, IR-33 North and South, IR-34, IR-37, IR-44, IR-48, IR-53, IR-55, IR-65, IR-66, IR-67, IR-68, IR-69, and IR-70. Based on known hydrogeologic conditions at Parcel D, it is assumed that a minimum well yield of 150 gallons per day could also be achieved from

A-aquifer wells at these IR sites (PRC, LFR, and U&A 1996). A-aquifer groundwater in these areas was further evaluated against the site-specific factors below.

In a 1999 letter, EPA provided the Navy with additional guidelines for applying the federal criteria (EPA 1999a). An attachment to the letter (referred to as "Enclosure 5") listed site-specific factors that can be considered in deciding whether all or portions of an aquifer should be considered a potential source of drinking water. This letter is provided as an attachment to Appendix D. These factors include the following: (1) aquifer thickness, (2) TDS levels measured, (3) groundwater yield, (4) proximity to saltwater and the potential for saltwater intrusion, (5) the quality of underlying water-bearing units, (6) the existence of institutional controls on well construction or aquifer use, (7) information on current and historical use of the aquifer on the base or in the community surrounding the base, and (8) the cost of cleanup to federal drinking water standards. In addition, the BCT considered depth to groundwater a relevant site-specific factor because shallow aquifers are susceptible to contamination and may not be suitable sources of drinking water as a result.

The Navy evaluated seven of the eight factors listed above. Not included was factor number five, the quality of underlying water-bearing units. Quality of underlying water-bearing units was not considered because the B-aquifer at Parcel D is isolated and limited, and the deep bedrock water-bearing zone at Parcel D was not identified or investigated.

Table 2-3 summarizes the results of each of the eight site-specific factor evaluations and the overall potential for the A-aquifer to be used as a source of drinking water in each of the IR sites that meet the federal TDS criterion. The Navy believes that the A-aquifer underlying each of these sites has no potential to be used as a source of drinking water, based on the eight evaluation factors in Table 2-3, and on the key criteria presented below.

- **Aquifer thickness and depth to groundwater:** Generally, the depth to groundwater for the A-aquifer is less than 10 feet across Parcel D. The average thickness of the A-aquifer is approximately 25 feet, with a maximum thickness of approximately 40 feet (see Figure 2-7). Together, these two site-specific factors indicate the A-aquifer at Parcel D is very shallow and of limited extent, and therefore may not be suitable as a potential source of drinking water.

- **Existence of institutional controls on well construction or aquifer use:** California Department of Water Resources Bulletins 74-81 and 74-90 provide standards for well construction in California (Department of Water Resources 1981, 1991). These bulletins indicate that an individual domestic well must have a minimum seal of at least 20 feet from the ground surface, and a community water supply well must have a minimum seal of at least 50 feet from the surface for the wells to be used for water supply. Wells installed in the A-aquifer would not meet the minimum well seal requirements because of the shallow depth to groundwater at Parcel D (less than 10 feet). These well construction standards also prohibit installation of domestic wells within 50 feet of a storm drain or sanitary sewer line. Figure 2-11 shows areas of Parcel D that are beyond 50 feet of a sewer line and meet the TDS requirements.

As shown on Figure 2-11, most of Parcel D is within the 50-foot buffer zone from the sewer lines. Although these lines will be removed by the Navy, this figure shows the likely density of sewer lines that would be installed by the City and County of San Francisco during redevelopment of HPS. As a result, installation of domestic wells would be prohibited in many portions of the A-aquifer at Parcel D. Also, the City and County of San Francisco regulations prohibit installation of domestic wells within city boundaries. Based on the existence of these local and state institutional controls that prohibit or severely restrict locations where new potable wells can be installed, there is low potential for use as a source of drinking water because of these institutional controls.

- **Proximity to saltwater and actual TDS values:** Although a large portion of the A-aquifer at Parcel D meets the federal TDS criterion (10,000 mg/L) to be considered as a potential source of drinking water, the actual TDS values are still high. Additionally, much of Parcel D is near the Bay, which contains saltwater or brackish water. Together, these two site-specific factors suggest that TDS values will increase as a result of saltwater intrusion if significant quantities of water are withdrawn from the A-aquifer at Parcel D. They further suggest that this aquifer will ultimately not be suitable for use as a source of drinking water. Based on these site-specific factors, the A-aquifer at Parcel D is considered to have low potential for use as a source of drinking water.

- **Historical and Current Groundwater Use:** A-aquifer groundwater at HPS has never been and is not currently used as a drinking water source (PRC, LFR, and U&A 1996). San Francisco currently obtains its municipal water supply from the Hetch Hetchy watershed in the Sierra Nevada and plans to continue using the Hetch Hetchy watershed as a drinking water source in the reasonably foreseeable future (Tetra Tech 1999). Based on historical and current use, A-aquifer groundwater at HPS has low potential to be used as a future drinking water source.

- **Cost of Cleanup to Federal Drinking Water Standards**: Antimony, arsenic, chromium, magnesium, nickel, thallium, zinc, and other metals are components of the Franciscan Formation bedrock and bedrock-derived fill that underlies HPS. The A-aquifer contains fill material derived from the Franciscan Formation. During the RI, Hunters Point groundwater ambient levels (HGAL) were estimated for naturally occurring metals (PRC, LFR and U&A, 1996). The HGALs for antimony, arsenic and thallium exceed their respective maximum contaminant levels (MCL), even though these MCLs are federal drinking water standards. While the Navy has not calculated the cost to reduce concentrations of these naturally occurring metals to below MCLs in groundwater, the cost would likely be prohibitive, and it may be technically impracticable to do so. Based upon this site-specific factor, there is low potential for the A-aquifer groundwater at HPS to be used as a drinking water source.

As shown on Figures 2-7 and 2-12, the B-aquifer is present in only a few small, laterally discontinuous areas at Parcel D. The largest area of the B-aquifer at Parcel D is near the center of Parcel D and is interpreted to be 20 feet thick, 1,500 feet wide, and 1,000 feet long. TDS

concentrations in groundwater samples collected in this area of the B-aquifer were generally below state and federal TDS criteria. Figure 2-12 presents the maximum TDS values detected in the B-aquifer monitoring wells. Based on the TDS data alone, the B-aquifer at Parcel D would be considered suitable as a potential source of drinking water. The evaluation of other site-specific factors in this area indicated that the B-aquifer has low potential for use as a source of drinking water. These other site-specific factors include (1) the limited volume and storage capacity of the confined B-aquifer, (2) the existence of institutional controls that prohibit installing water supply wells within City and County of San Francisco limits and locating wells within 50 feet of a sanitary sewer or storm drain (see Figure 2-12), and (3) the current and historical uses of the B-aquifer (which has never been used for water supply at HPS). Therefore, the B-aquifer is considered to have a low potential for use as a source of drinking water. However, because of agreements made with the BCT on the HHRA, the groundwater ingestion pathway is included in the risk assessment for the B-aquifer. This assumption provides an additional layer of conservatism for the protection of human health at HPS.

2.3 PARCEL D INVESTIGATION HISTORY

Parcel D has been investigated following the CERCLA process. Parcel D underwent a sequence of initial investigations from 1988 to 1996. Investigations began with a preliminary assessment, which involved record searches, interviews, and limited field investigations. Sites that required further investigation were considered during the site inspection phase, which involved collection and evaluation of additional field data. Finally, sites that required even further investigation were considered during the RI phase. The RI was followed by a FS, proposed plan, ROD, risk management review (RMR), and revised FS. The following subsections summarize the significant aspects of the RI, FS, proposed plan, ROD, RMR, and revised FS.

Table 2-4 briefly describes each IR site at Parcel D and summarizes past cleanup actions and recommendations presented in past reports for Parcel D. Detailed descriptions and findings can be found in the original documents. In the various investigations and reports, areas requiring remediation were given unique alpha-numeric identifiers. Large areas were called remediation areas and their identifiers started with "RA." Small areas were called "*de minimis*" areas and their identifiers started with "DM." In order to present information consistent with previous reports, Table 2-4 includes these alpha-numeric identifiers.

2.3.1 Remedial Investigation

A draft final Parcel D RI was completed on October 25, 1996, and addressed the original 27 IR sites in Parcel D (PRC, LFR, and U&A 1996). The RI became final on January 31, 1997, following submission of responses to agencies' comments on the draft final version (Tetra Tech 1997b). The two most significant aspects of the RI report are (1) the site characterization of contaminants and (2) the HHRA. No ecological risk assessment was conducted because there is no ecological habitat of concern at Parcel D because most of the parcel is an industrial setting covered by buildings or pavement.

The HPS IR sites were characterized using biased sampling in areas where chemicals were known to have been used, stains were observed, or the potential for spills existed. These IR sites were delineated as buildings or areas that had been used for various industrial processes. The site chemical characterization presented in the RI compared chemical compounds in the soil and groundwater with a variety of regulatory screening criteria concentrations. Those chemicals that exceeded screening criteria were posted on a series of IR site maps. The maps illustrated the location of chemicals with respect to potential sources, and recognizable spatial patterns. The RI documented the site characterization activities.

The HHRA conducted for Parcel D during the RI was similar to that conducted in the other parcels at HPS and was designed by the HPS BCT. All of the parcels were evaluated for three human health risk scenarios: (1) the current land use, which was industrial; (2) a future industrial land use; and (3) a future residential land use. The question of the appropriate exposure area for a site industrial worker or resident was discussed by the BCT prior to completing the HHRA, and the BCT decided to use a grid system for conducting the parcel-wide risk assessment. The final grid size agreed to by the BCT was 0.5 acre for an industrial scenario. In addition, it was assumed that construction and maintenance activities could bring soil from a depth of 10 feet to the surface and, therefore, contamination from 0 to 10 feet below ground surface (bgs) should be considered in the HHRA. As a result, the human health risk was calculated for all of the samples between 0 and 10 feet bgs within the 0.5-acre grid cell, and the total cumulative risk for that cell was reported in the HHRA.

No risk management evaluations were included as part of the RI. Instead, the BCT decided that all of the 27 IR sites described in the RI would be assessed during the FS evaluation since all 27 IR sites contained exposure areas (HHRA grid cells) that exceeded at least one of the screening criteria; that is, an excess lifetime cancer risk (ELCR) greater than 10^{-6} for a future industrial worker or resident, a segregated HI greater than 1, or lead concentrations exceeding 1,000 milligrams per kilogram (mg/kg).

2.3.2 Feasibility Study

The draft final Parcel D FS was submitted on January 24, 1997 (Tetra Tech 1997a), and became final on August 29, 1997, following an extended period of written comments and responses (Tetra Tech 1997d). The FS used the results and analyses in the RI report to identify, screen, and evaluate remedial alternatives for Parcel D and to define areas for proposed remedial action. Three different cleanup scenarios and associated cleanup goals were considered in the FS. Scenario 1 consisted of cleanup to the industrial land use scenario with a 10^{-5} ELCR; Scenario 2 consisted of cleanup to the industrial land use scenario with a 10^{-6} ELCR; and Scenario 3 consisted of cleanup to the residential land use scenario with a 10^{-6} ELCR. For each of these scenarios, the costs of cleanup and the areas that exceeded the cleanup goals were defined for each of the remedial alternatives proposed. Each scenario also considered cleanup of soils representing an HI greater than 1 and lead concentrations greater than 1,000 mg/kg.

The FS used the RI data to delineate those areas that exceeded the different cleanup goals for each reuse scenario and cleanup level. The HHRA results were used to identify chemicals that were risk drivers, and the RI characterization data were used to define the extent of the cleanup areas. The lateral extent of the soil cleanup areas in each IR site was determined by either (1) defining the interpreted lateral extent of chemicals considered risk drivers for the area, or (2) assuming an 8-foot-wide by 8-feet-long area for locations having a single boring with chemicals exceeding risk-based concentrations (RBC). The 8-foot by 8-foot area was proposed based on the assumed smallest possible sized excavation that would not requiring sidewall shoring. The vertical extent of each area was determined to be 2 feet below the deepest sampling location that contained a chemical exceeding the screening criteria, the depth to the shallowest water table, or 10 feet bgs, whichever was shallowest. The industrial land use scenario and cleanup goals resulted in 20 IR sites containing soil cleanup areas, while the residential scenario and cleanup goals resulted in 23 IR sites containing soil cleanup areas. No risk management evaluations were conducted as part of the FS, and all soil cleanup areas that exceeded at least one of the various cleanup criteria under each reuse scenario were identified in the final FS.

2.3.3 Proposed Plan and Record of Decision

The proposed plan for Parcel D was published on May 11, 1997 (Tetra Tech 1997c), and a public meeting was held on May 21, 1997. The Navy's preferred remedy was to excavate the contaminated soils, dispose of the soils off site, and backfill with clean soil. The cleanup goal chosen corresponded to a cumulative 10^{-5} ELCR and an HI of 1 based on an industrial reuse scenario and lead concentrations in soil of 1,000 mg/kg. One of the 20 IR sites was not included in the proposed plan because the parcel boundary was changed so that IR-36 was excluded from Parcel D and included in Parcel E. As a result, the proposed plan included 19 IR sites for soil remediation.

The comments received during the public comment period did not change the proposed remedy or the areas proposed for remedial action. The comments did raise the issue of the recommended 10^{-5} ELCR cleanup goal, with a cleanup goal of 10^{-6} ELCR being preferred by some responders. The Navy determined that the original recommended cleanup goal of 10^{-5} ELCR was the most appropriate approach, and it was included in the ROD.

The draft Parcel D ROD was submitted to the regulatory agencies on November 3, 1997 (Tetra Tech 1997e). As presented in the draft ROD, the selected remedy was excavation and off-site disposal of soils based on the cleanup goals described in the proposed plan. Subsequent to the submittal of the draft ROD, the costs and environmental improvements associated with the selected soil remedy for Parcel D were reviewed by the Navy. Navy concerns regarding the level of risk reduction, cost effectiveness of the cleanup approach, and discussions with other members of the BCT resulted in the RMR.

2.3.4 Risk Management Review Process

The RMR process was developed and conducted during a series of meetings held by the Navy and the regulatory agencies from January through April 1999. The process employed various

criteria and decision rules to reevaluate whether remedial actions were required at 19 of the 27 IR sites in Parcel D that were originally determined to require remedial actions for soil. The primary decision questions were:

- Is the site adequately characterized?
- Has a change in regulatory screening criteria eliminated risk drivers at the site?
- Are risk drivers associated with ambient conditions in fill or asphalt surface cover?
- Have removal actions or other actions reduced risk to an acceptable level?
- Are there other mitigating factors that reduce risk to an acceptable level?

The RMR consisted of a comprehensive evaluation of each IR site. The data for the entire site, including the nature and extent of soil contamination and specific chemicals driving the risk to human health were reviewed and evaluated during the 10 RMR meetings. All soil contamination identified between 0 and 10 feet bgs was considered in the RMR process. During the review, the nature and extent of soil contamination was re-evaluated, including assessment of the major risk "drivers" defined as the chemicals that contribute over 90 percent of the total risk, and mitigating factors associated with the type and location of chemicals detected in soil samples. The adequacy of the site characterization was considered a significant evaluation factor by the risk management review team and was one of the first aspects reviewed. The reasonably anticipated future use of the Parcel D sites, as specified in the July 1997 Redevelopment Plan, was also considered during the RMR process (San Francisco Redevelopment Agency 1997).

Regulatory screening criteria had changed since the HHRA was conducted for the RI. During the RMR process, the 1998 EPA preliminary remediation goals (PRG) were used to evaluate site risks. The 1998 PRGs differed from the 1995 PRGs used in the RI. The 1998 PRGs incorporated revised input parameters. Since 1995, EPA had developed new guidance for risk assessment input parameters for several classes of chemicals, which was used during the RMR process. The revised 1998 EPA guidance included (1) recommending evaluating beryllium only under the inhalation route for cancer effects and eliminating the oral slope factor; (2) updated oral and inhalation slope factors for the polychlorinated biphenyls (PCB) Aroclor-1254 and Aroclor-1260; (3) new reference doses for approximately 20 noncancer chemicals; (4) updated soil-to-skin adherence assumptions for adult and child receptors; and (5) updated skin surface area values for adult and child receptors (EPA 1998d).

During the Parcel D RMR process, the significance of arsenic detections was balanced according to several factors: (1) the 1998 residential Region 9 PRG, which was 0.38 part per million (ppm) for a 1 in a million excess cancer risk and 21 ppm for noncancer endpoints, and (2) the HPAL for arsenic at 11 ppm, which is the 95th percentile of the unimpacted soil concentrations detected at HPS. The BCT agreed to use "twice the HPAL" or 22 ppm as the site-specific arsenic goal, which is consistent with EPA's general goal to manage risks to within the risk range (1×10^{-4} to 1×10^{-6}) and below an HI of 1. However, spatial distributions, both vertically and horizontally,

operational histories of the site, sampling density, soil horizons, volume of soil impacted, and concentrations were also considered to evaluate the need for CERCLA response action. It should be noted that the 1999 industrial PRG for arsenic's noncancer endpoints was 22 ppm.

The Navy agreed that EPA's guidance for remedial actions at Superfund sites with PCB contamination was appropriate guidance to be considered for the RMR process (EPA 1990b). This guidance states that action levels in the range of 10 to 25 mg/kg should be established for PCB cleanups in soil at industrial sites, with a limit of 1 mg/kg for residential use. After considering site-specific conditions at HPS that may affect exposure, the Navy selected the conservative end of the industrial range provided in the EPA guidance (EPA 1990b). Therefore, under the RMR process, a total PCB action level of 10 mg/kg was considered by the Navy as protective of human health and the environment for industrial reuse areas, such as Parcel D. As noted in the EPA guidance, a PCB concentration of 10 mg/kg equates to an estimated ELCR of 1×10^{-5}, under an industrial reuse scenario. Although the Navy and EPA agreed it was appropriate to consider this guidance during the Parcel D RMR process, DTSC disagreed with this approach and preferred to use the 1998 industrial PRG of 1.3 mg/kg, which equates to an ELCR of 1×10^{-6}.

At the conclusion of the RMR process, the review team confirmed or eliminated sites from proposed remedial action based on current risk. After completion of the review, all sites fell into one of the following three categories: (1) sites that the team agreed no response action was required, (2) sites that the team agreed response action was required, and (3) sites that the team did not yet agree on the course of action. The results of the RMR process are documented in the draft final Parcel D RMR process report (Tetra Tech 2000a). Table 2-4 briefly summarizes the Navy's RMR recommendations and Appendix J, Attachment J-2, includes additional RMR summary tables from the Parcel D RMR process report.

The Navy conducted a TCRA for soil sites based on the results of the RMR process, which are later described in Section 2.4 of this report. The TCRA cleanup goals are listed in the "Final Sampling and Analysis Plan Parcel D Soil Site Delineation" (Tetra Tech 2000b).

2.3.5 Draft Revised Feasibility Study

The Navy submitted the draft Parcel D revised FS report on March 8, 2002. The revised FS combined existing RI data with new data collected after completion of the RI. The data were summarized and evaluated in the revised FS report to refine the site conceptual model, further define the nature and extent of contamination, assess potential risks based on existing site conditions, and develop and evaluate revised alternatives. The data evaluation included (1) a comparison of new and existing data to updated screening criteria, (2) a revised evaluation of groundwater beneficial uses and exposure pathways, and (3) a revised assessment of potential risk posed through exposure to soil and groundwater at Parcel D. Following data evaluation, RAOs were developed. These RAOs were stated in terms of a risk range rather than specific concentrations for contaminants. These RAOs were determined to be insufficient to support the conveyance agreement subsequently signed with the City and County of San Francisco (Navy and San Francisco Redevelopment Agency 2004). Remedial alternatives developed in the draft Parcel D revised FS report included no action and institutional controls.

2.4 PARCEL D REMOVAL AND CLEANUP ACTIONS

This section discusses removal and cleanup actions that were conducted at Parcel D. Completed actions include the facility-wide underground storage tank (UST) and aboveground storage tank (AST) removal actions, the sandblast grit removal action, the Pickling and Plate Yard (IR-09) removal action, the exploratory excavation (EE) removal action, the storm drain sediment removal action, the non-VOC soil TCRA, the soil stockpile removal action, the radiation TCRA, and the waste consolidation cleanup action. Further action may be conducted under the facility-wide radiation TCRA. No additional removal actions are planned for Parcel D. Each removal and cleanup action is discussed below.

2.4.1 Polychlorinated Biphenyl Transformer Removal

In 1988, 199 transformers located throughout HPS were removed from their original locations by American Environmental Management Corporation and the Navy's Public Works Department (Harding Lawson Associates 1990).

After the transformer cleanup action, YEI Engineers, Inc. conducted an investigation of transformer locations at HPS in 1988. During this investigation, all known oil-containing electrical equipment were inspected, inventoried, and sampled (YEI Engineers, Inc. 1988). In 1994, a basewide site inspection of the former transformer locations was conducted (Harding Lawson Associates 1994). Also in 1994, the transformer sites were designated as IR-51 in compliance with the basewide IR Program.

2.4.2 Parcel D Underground and Aboveground Storage Tank Removal Actions

The Navy removed or closed in place 10 USTs at Parcel D during the Phase I UST removal program in 1991 and the Phase II removal program in 1993. Of these 10 USTs, 9 were removed and 1 was closed in place. The Parcel D USTs ranged in size from 30 to 7,000 gallons, and contained gasoline, diesel, waste oil, hydraulic fluids solvents, or fuel oils. The location, capacity, contents, and status of each UST and AST at Parcel D are summarized in Appendix G of the draft final Parcel D RI report (PRC, LFR, and U&A 1996). Figure 2-13 shows the UST sites at Parcel D.

2.4.3 Parcel D Sandblast Grit Cleanup Action

Sandblast operations were conducted at numerous locations at HPS, including Parcel D. These operations generated sandblast grit that may have contained paint chips, heavy metals, and oil. Between 1991 and 1995, 4,665 tons of sandblast grit was collected and consolidated in Parcel E. Subsequently, about 245 tons of sandblast grit was collected from eight small piles around HPS. Approximately 90 tons of sandblast grit was removed from IR-44 in Parcel D and recycled (Battelle 1996). The grit was sent to an asphalt plant, where it was reused in the manufacture of asphalt. This cleanup action was completed in 1995 (Battelle 1996).

2.4.4 Pickling and Plate Yard Removal Action at IR-09

Between 1947 and 1973, the Navy used the Pickling and Plate Yard at IR-09 for industrial metal finishing and painting (PRC, LFR, and U&A 1996). Steel plates were dipped in acid baths, dried on concrete drying racks, and painted with a corrosion-resistant zinc chromate-based paint. Residual hazardous liquid and sludge remained in the dip sumps, and residual paint covered several steel and concrete structures.

The removal action at the Pickling and Plate Yard began in November 1994 and was completed in March 1996. The purpose of the removal action was to remove and dispose of hazardous materials and structures affected by hazardous surface residues at the site. The following structures were located at the Pickling and Plate Yard: three partially below-ground steel pickling sumps lined with acid-resistant brick and housed in an open concrete containment vault; concrete plate drying racks; concrete plate storage racks; three empty acid storage tanks; two buildings; and a large overhead crane system (PRC, LFR, and U&A 1996). Activities completed during the removal action included (1) removing and disposing of the pickling sumps, including the brick lining; (2) securing the containment vault; (3) removing and disposing of zinc chromate residue; and (4) demolishing and disposing of various structures, including three acid storage ASTs, and the plate storage and drying racks. Approximately 200,000 pounds of hazardous waste liquids; 1,500 cubic yards of hazardous waste solids; 100,000 pounds of nonhazardous liquids; and 350,000 pounds of scrap metal were disposed of during this removal action. After the structures had been removed, surface soil samples were collected for analysis of chromium VI. The samples were analyzed using a field test kit. Several samples showed elevated results.

2.4.5 Parcel D Exploratory Excavation Removal Action

EEs were conducted to remove hazardous substances in soil at sites determined to pose a threat to human health and the environment, as documented in the EE action memorandum (Navy 1996). Five EE sites (EE-12 and EE-14 through EE-17) were located in Parcel D (see Figure 2-13). Removal actions at these EE sites are summarized below and shown on Figure 2-13.

- **EE-12**: Soil containing metals, PCBs, polynuclear aromatic hydrocarbons (PAH), and petroleum hydrocarbons was excavated from a 34-by-25-by-28-foot triangular area to an average depth of 10 feet bgs. Approximately 130 cubic yards of soil was excavated. EE-12 is located in IR-33 North.

- **EE-14:** Soil containing metals, PCBs, and petroleum hydrocarbons was excavated from a 13-by-26-foot area to an average depth of 3 feet bgs. Approximately 37 cubic yards of soil was excavated. EE-14 is located in IR-37.

- **EE-15 and EE-16:** EE-15 and EE-16 are adjacent sites and were excavated as one area. Soil containing metals and petroleum hydrocarbons was excavated to a depth of 2 feet bgs from an irregularly shaped area measuring approximately 900 square feet. Approximately 70 cubic yards of soil was excavated. EE-15 and EE-16 are located in IR-53.

- **EE-17**: Soil containing metals and petroleum hydrocarbons was excavated to a depth of 7 feet bgs from an irregularly shaped area measuring approximately 420 square feet. Approximately 110 cubic yards of soil was excavated. EE-17 is located in IR-70.

Excavated soil was disposed of at an off-site landfill. At each EE site, confirmation samples were collected and analyzed to ensure that the removal action criteria were met. Subsequently, the excavations were backfilled and the sites were regraded. The field activities for the EE removal action began in mid-1996 and were completed in February 1997. All field activities conducted and analytical data collected during the EE removal action are documented in the completion report (International Technology Corporation [IT Corp.] 1998).

2.4.6 HPS Storm Drain Sediment Removal Action

Sediment was removed from the storm drain system to lessen potential transport of contaminated sediments through the system to the Bay. Site inspection results indicated that (1) storm drain sediments in Parcels B, C, D, and E contained hazardous substances at concentrations that may have posed a risk to the environment and (2) storm drain integrity is poor in several locations (PRC, LFR, and U&A 1996). The removal action involved removal of sediments and debris from the storm drain lines, catch basins, and manholes; pre- and post-cleaning video inspections of the pipelines; and water jetting of the pipelines, catch basins, and manholes. Sediments generated during the removal action were dewatered, sampled, and analyzed for appropriate disposal. Over 1,200 tons of sediment was removed from the storm drain system including Parcel D. The removal action began in October 1996 and was completed in early 1997 (IT Corp. 1997).

2.4.7 Parcel D Time-Critical Removal Action for Non-Volatile Organic Compounds in Soil

In 2001, the Navy conducted a TCRA to remove hazardous substances in soil at sites determined to pose a threat to human health under the proposed future reuse scenario (residential for IR-37 and industrial for all other Parcel D sites). Soil at Parcel D did not contain VOCs; as a result, the TCRA addressed only non-VOC compounds. TCRA sites were identified during the RMR process and were further characterized during field investigations prior to the TCRA. TCRA sites were identified at IR-08, IR-09, IR-37, IR-53, IR-55, and IR-65. Removal actions conducted at these sites are summarized below.

- **IR-08**: Approximately 13 cubic yards of soil containing PCBs was excavated from RA-4. The cleanup goal for PCBs was 1 mg/kg.

- **IR-09**: Soil in DMs 6864, 6965, 6967, and 7167 was further characterized for chromium VI. This investigation provided additional characterization of soil after the Pickling and Plate Yard removal action. Concentrations of chromium VI in these areas were less than the TCRA cleanup goal of 10 mg/kg in this area

- **IR-37:** Approximately 25 cubic yards of soil containing PCBs was excavated from RA 37-1; the cleanup goal for PCBs was 1 mg/kg. Approximately 44 cubic yards of soil containing antimony was excavated from RA 37-2. The cleanup goal for antimony was 19 mg/kg in this area.

- **IR-53:** Approximately 6 cubic yards of soil containing PAHs was excavated from DM 11260. The cleanup goal for benzo(a)pyrene was 0.33 mg/kg.

- **IR-55:** Approximately 7 cubic yards of soil containing lead was excavated from DM 10676. The cleanup goal for arsenic was 11 mg/kg throughout Parcel D.

- **IR-65:** Approximately 12 cubic yards of soil containing arsenic was excavated from DM 8866. The cleanup goal for arsenic was 11 mg/kg.

Excavated soil was disposed of at an off-site landfill. At each site, confirmation samples were collected and analyzed to ensure that the TCRA cleanup goals were met. Subsequently, the excavations were backfilled and the sites were regraded.

Steam and fuel lines were also addressed during the TCRA. The steam lines were constructed in the 1950s and operated until 1984. The steam pipes are covered in asbestos pipe lagging insulation in most areas. The Navy leased portions of HPS to Triple A from 1976 to 1986; it was alleged that Triple A used sections of the abandoned steam lines to transfer waste oil. Steam lines that were saturated with oil were removed under the TCRA. Most steam lines on Parcel D were left in place after the asbestos abatement. Areas where the asbestos was damaged were inspected for liquids, oily waste, or staining. Steam lines were pressure tested with compressed air when wipe samples exceeded project requirements or when visible waste oil was in the pipe. Samples of liquids or wipe samples from the inside of the pipe were collected. Asbestos was not removed on pipes that remained in place. The inside surface of the pipes were cleaned out with a vacuum truck followed by pressure washing where residual fluids remained. In addition, soil samples were collected where releases were suspected. In a few instances, soil sample results exceeded the TCRA goals, resulting in further excavation until bottom samples met the goals of the TCRA (Tetra Tech 2001b). In addition, a 150-foot segment of fuel line was removed from Parcel D during the TCRA. Waste materials were disposed of in appropriate off-site permitted facilities. All field activities conducted and analytical data collected during the TCRA are documented in the closeout report (Tetra Tech 2001b).

2.4.8 Parcel D Radiological Time-Critical Removal Action

A radiological TCRA is ongoing at several locations at Parcel D. These actions are discussed in the historical radiological assessment of HPS, completed in August 2004 (RASO 2004). The radiological TCRA began at Building 364 and the surrounding area in February 2001 to remove contamination from the former site of a cesium-137 spill. Soil and a waste tank pit were removed. Further investigation, remediation, and surveying were conducted in 2002 (RASO 2004).

The historical radiological assessment identified the following Parcel D sites as radiologically impacted: Building 274, Building 313 site, Building 313A site, Building 317 site, Building 322 site, Building 351, Building 351A, Building 364, Building 365, Building 366, Building 383 Area, Building 408, Building 411, the former NRDL site on Mahan Street, the Gun Mole Pier, Building 813, and Building 819 (RASO 2004). The historical radiological assessment summarizes the assessments, investigations, and surveys completed and the recommendations for the impacted sites at Parcel D (RASO 2004). Recommended actions are ongoing under the facility-wide radiological TCRA. The action memorandum for the facility-wide TCRA specifies that radiological contamination will be addressed by removal and off-site disposal (Navy 2001). Documentation of completed activities is under preparation.

2.4.9 Parcel D Soil Stockpile Removal Action

In July and August 2003, the Navy inventoried all the stockpiles at HPS and identified 37 piles located within the current Parcel D boundary (Tetra Tech and ITSI 2005). Two other stockpiles (SPD37 and SPD41) were formerly located within Parcel D but are now located within the boundary of Parcel E, based on the 2005 revised boundary between the two parcels. Each stockpile was surveyed to document the location, estimate the volume, and establish photo documentation of each pile. Each stockpile was also assigned a unique identification number. All 37 stockpiles located at Parcel D are shown on Figure 2-14.

In February 2004, nine stockpiles were removed from Parcel D (SPD23 through SPD31) as part of a TCRA. All of the stockpiles consisted primarily of soil, except for the three stockpiles in or near IR-17 (SPD28, SPD29, and SPD30), which consisted mostly of asphalt. Soil samples were collected from the stockpiles to characterize the material for appropriate off-site disposal, and confirmation samples were collected from beneath the stockpiles that were located on native soil to assess if the removal action was complete (Tetra Tech and ITSI 2005). Table 2-5 lists the 28 Parcel D stockpiles for future removal, and Figure 2-14 shows the location of these piles. Based on the 2003 investigation, these stockpiles contain approximately 560 cubic yards of material for disposal, including an estimated 540 cubic yards of soil and 20 cubic yards of asphalt and other material.

As part of the same TCRA used for the soil stockpile removal, the Navy also excavated a buried fuel line site that was given the unique identifier DM BK32. This DM area designation was not part of the RMR process, and this DM designation does not appear as part of the IR evaluation in Table 2-4. The removal at DM BK32 consisted of clearing the surface area, excavating soils,

surveying the excavation area, collecting confirmation samples, disposing of excavated soil off site, and backfilling the excavation (Tetra Tech and ITSI 2005).

An additional area (DM 9363) was proposed in the TCRA for removal. This site is located inside Building 306 in IR-35. The building formerly housed a transformer that leaked PCBs and containers that reportedly contained PCBs. However, the evidence was only visual (staining in the underlying concrete and gravel). Since no removal was undertaken at the site, an additional investigation of this area is recommended.

2.4.10 Parcel D Waste Consolidation Cleanup Action

The purpose of the waste consolidation cleanup action was to identify and address potential environmental issues associated with the industrial use of buildings in Parcel D that could impact the planned transfer of the property to the City and County of San Francisco of San Francisco. From April to July 2002, surveys were conducted in and around 69 buildings in Parcel D to identify industrial process equipment, materials, structures, and other miscellaneous items that could pose a health risk and to locate and identify Resource Conservation and Recovery Act (RCRA), non-RCRA, or universal wastes. From May 2002 to April 2003, samples were collected and analyzed from various industrial process equipment and waste consolidation items to identify those requiring action (decontamination, labeling, or removal) to support the Parcel D property transfer. From April 2002 to June 2003, decontamination and waste consolidation and disposal activities were conducted. Decontamination and waste consolidation and disposal activities are summarized below.

- Encapsulating or removing asbestos-containing material
- Removing and disposing of structural materials, paint booths, and numerous abandoned waste items
- Removing and disposing of hoods, vents, and ducts associated with industrial processes
- Removing or disabling existing aboveground storage tanks
- Cleaning industrial process-related sumps, vaults, trenches, and equipment foundations

At the conclusion of the decontamination and waste consolidation activities, unoccupied buildings in Parcel D were secured to limit unauthorized access and to aid in maintaining the buildings in a condition suitable for transfer (Foster Wheeler Environmental Corporation 2003).

2.4.11 Total Petroleum Hydrocarbon-Contaminated Soil Excavation

In 2004, one location, CAA-4, at Parcel D was excavated to remove TPH-contaminated soil (see Figure 2-13). The removal was conducted under the HPS TPH Corrective Action Program, which addresses areas of TPH contamination. The goal of the excavation activities was to remove soil that contained TPH at concentrations exceeding the cleanup level of 3,500 mg/kg. The excavation footprint was delineated based on a screening evaluation of existing analytical data. After excavation, confirmation samples were collected and analyzed for TPH and TPH-related chemicals of concern (TPA-CKY 2005).

2.4.12 Storm Drain and Sanitary Sewer Removal Action

In 2007, the Navy began investigating the storm drains and sanitary sewer lines for potential radiological contamination. These lines will be removed and disposed of because the investigation requires removing these utilities to begin the radiological testing. This action is currently ongoing under the "Revised Basewide Storm Drain and Sanitary Sewer Removal Action Work Plan" and is expected to be completed in 2008 (Tetra Tech EC 2007).

2.5 Extent of Contaminated Soil and Groundwater

This section presents an overview of the current extent of contamination present in Parcel D soil and groundwater based on data collected through June 2004. The COCs identified based on the results of the HHRA and environmental evaluation summarized in Section 3.0 were used to focus the discussion of soil and groundwater contamination presented in this section. In accordance with the HHRA in Section 3.0 and Appendix B, COCs are those analytes that drive risk in ECLR risk greater than 1×10^{-6} or an HI greater than 1. In addition, COCs in groundwater were identified that present a potential threat to the Bay based on the evaluation of groundwater data as compared to surface water screening criteria (see Section 3.2). These COCs are also the focus of this FS report and will require remedial action by the Navy.

The nature and extent of contaminants in soil and groundwater at Parcel D were presented in greater detail in the previous RI and FS reports (PRC, LFR, and U&A 1996; PRC and LFR 1997). The nature of contaminants at Parcel D can mostly be attributed to industrial activities by the Navy or other tenants, except for several metals found at ambient concentrations.

The Navy maintains a comprehensive database of analytical results reported at HPS for both soil and groundwater. Because this section is meant to provide an overview of the extent of contaminants that pose the greatest risk at Parcel D, sample-specific data are not presented in the figures and tables of this section. Sample-specific information is presented in Appendix A. Appendix A includes figures showing sampling locations with sample identification labels and tables of sample analysis data for both Parcel D soil and groundwater. For soil sample data, soil sampling locations that were removed as part of an interim action have been excluded from these tables. Confirmation sample data collected during these removal actions are included in the data set. The groundwater sample data tables include all available analytical data through June 2004.

The Appendix A data tables are provided electronically on compact disk due to the large volume of information.

Section 2.5.1 describes the extent of the soil COCs at Parcel D. Figure 2-15 presents all soil sampling locations within Parcel D and indicates those locations that have been removed. Figure 2-15 is presented at a scale that shows the density of soil sampling across Parcel D, but does not allow for the inclusion of sample identification labels. Figures showing the sampling locations with their identification labels are included in Appendix A as referenced on Figure 2-15. Section 2.5.2 describes the extent of the selected groundwater COCs at Parcel D. Figure 2-16 presents the groundwater sampling locations in Parcel D.

2.5.1 Parcel D Soil Characterization

The following sections briefly discuss the analytical groups for which soil was analyzed: metals, VOCs, semivolatile organic compounds (SVOC), pesticides and PCBs, and cyanide. For each analytical group, data summary tables list various statistics, including percent detected, average concentration, and the standard deviation. The percent detected shows the frequency at which the analyte is detected. Standard deviation is a statistic that shows the variability of the data; a large standard deviation indicates that the data values differ greatly from the mean, and a small standard deviation indicates that they do not vary greatly from the mean.

Figures 2-17 through 2-28 present soil characterization results for each of the soil COCs. These figures show all sampling locations where the COC was analyzed and each location is symbol-coded as nondetect, detected below the comparison criteria, or detected above the comparison criteria. The comparison criteria for metals (except chromium VI) are the HPALs. HPALs are statistically calculated values representing ambient concentrations in soil for each metal (PRC 1995). In the case of chromium and nickel, the HPAL is a site-specific concentration based on a regression analysis using data for magnesium or cobalt. Samples were analyzed for magnesium, cobalt, or both where nickel or chromium was a COPC to obtain data for the regression analysis used to calculate the site-specific HPAL. An HPAL has not been derived for chromium VI and is simply compared with the laboratory's reporting limit. The comparison criterion for PAHs is the laboratory reporting limit of 0.33 mg/kg in soil. The laboratory reporting limit is the lowest practical concentration at which the laboratory can accurately detect the analytes. When concentrations are found above the laboratory reporting limit, but less than EPA's method detection limit, the data are qualified and flagged as an estimated value, but reported as a positive detection. In this FS report, all valid qualified data above the laboratory reporting limit and all valid data reported above the method detection limit are considered detected concentrations. These qualified detections are shown in the summary statistical tables presented in this section.

2.5.1.1 Characterization of Metals in Soil

Soil samples were collected and analyzed for 25 individual metals at Parcel D. Table 2-6 presents the statistical information for each of these metals for soil samples collected from 10 feet bgs or less, which represents near-surface soil conditions; Table 2-7 presents the statistical information for each of these metals for soil samples collected at depths greater than

10 feet bgs, which represent subsurface soil conditions. Tables 2-6 and 2-7 also provide a comparison of metal concentrations with their HPAL.

The Navy has evaluated potential sources of metals at Parcel D to assess where Navy activities may have contributed to metals concentrations in soil. For example, lead may be associated with industrial activities or paint. Section 3.0 and Appendix B present the risk associated with all metals based on the samples where the soils remain in place.

In addition to the industrial sources identified, the presence of metals across Parcel D is likely related to the fill and naturally occurring bedrock material. A group of metals related to the bedrock fill quarried to build HPS in the 1940s consistently exceeded risk-based criteria across Parcel D. These metals occur in the local HPS bedrock and were distributed throughout all parcels as HPS was built. The resulting distribution of ubiquitous metals concentrations in soil is nearly random in areas where fill is present. In this report, the term "ubiquitous" refers to metals that are naturally occurring or are in the same concentration ranges as naturally occurring metals in the source material (including material from the same geologic formations in the San Francisco area) that was used for filling at HPS. The Navy acknowledges that industrial sources of metals exist at HPS and that there is a potential that some metals in soil may be due to industrial sources and not from a naturally occurring source. The Navy has worked to remove contaminants from industrial sources during the removal actions taken to date, including exploratory excavations and time-critical removal actions. The Navy acknowledges that the DTSC does not agree with the Navy's position that ubiquitous metals are naturally occurring. Remedial alternatives developed in this FS address these concentrations of metals, regardless of their source."

The metals analysis data for all soil samples collected from near-surface depths are used in the revised HHRA presented in Section 3.0. The results of the HHRA identified three metals COCs that are the principal risk drivers for this analyte group: arsenic, lead, and manganese. In addition, chromium VI is considered a potential COC in soil because it is a possible source for the chromium VI plume present in the A-aquifer (see Section 2.5.2). As a result, these four metals are discussed below.

Arsenic

Arsenic is a naturally occurring semi-metal associated with bedrock of the Hunters Point Shear Zone. Figures 2-17 and 2-18 show analytical results for arsenic in soil samples collected at Parcel D from the near-surface and from the subsurface, respectively. Both of these figures show a widespread, ubiquitous distribution of arsenic detections. Less than 5 percent of detected arsenic concentrations exceeded the HPAL. The detections of arsenic concentrations greater than the HPAL are shown as red sampling locations on these figures, and indicate distributions throughout Parcel D, with no unique area or distinctive pattern that would indicate a release of arsenic. Review of the data shows that most of the detected concentrations above the HPAL of 11.1 mg/kg are within 30 percent of the HPAL. The highest detection, at boring IR65B004, was 47 mg/kg. Based on the results of the HHRA, remedial action is planned to address arsenic in soil above remediation goals.

Chromium VI

Chromium VI is considered to be an anthropogenic metal released during shipyard operations. Although chromium VI was not identified as a COC in soil based on the HHRA (see Section 3.0), characterization of chromium VI in soil at Parcel D is important because it is a potential source of groundwater contamination from activities at HPS. Figures 2-19 and 2-20 show analytical results for chromium VI in soil samples at Parcel D collected from the near-surface and from the subsurface, respectively. The statistics for chromium VI for the near-surface and subsurface soil intervals are reported in Tables 2-6 and 2-7. Both Figures 2-19 and 2-20 show the distribution of the detected results; the frequency of detections was less than 20 percent for both depth intervals. These figures show three areas where chromium VI primarily occurs in soils, near IR-09, IR-35, and IR-37. Comparing the analysis data for samples from the two depth intervals shows a higher frequency of detection and higher maximum detected concentration for the samples collected from the subsurface (greater than 10 feet bgs), compared to the samples collected from the near (0 to 10 feet bgs). No HPAL was established for chromium VI. The chromium VI distribution in soil does not always correlate with the chromium VI distribution in groundwater (see Section 2.5.2). Chromium VI has impacted the groundwater at IR-09, which correlates with the detected concentrations in the soil at that site; however, there is little groundwater impact at IR-37, and no impacts at IR-35 where chromium VI is also detected in soil. Previous remedial actions have addressed the concentrations of chromium VI in soil. However, the Navy will investigate the area at the Pickling and Plate Yard where field test kit results indicated the possibility of residual chromium VI in soil.

Lead

Lead is a naturally occurring metal associated with bedrock of the Hunters Point Shear Zone, but it also was used in various forms as part of shipyard operations — for example, as a component in paint. Figures 2-21 and 2-22 show analytical results for lead in soil samples at Parcel D collected from the near-surface and the subsurface, respectively. Lead was detected at a frequency of greater than 85 percent at both depth intervals. The distribution of lead is widespread, indicating a ubiquitous distribution of this metal at Parcel D in both depth intervals. About 35 percent of the detected lead results in the near-surface and 18 percent of the detected lead results in the subsurface depth interval exceeded the HPAL (see Tables 2-6 and 2-7). The depiction of samples exceeding the HPAL as red dots on Figures 2-21 and 2-22 appears greater than the 35 and 18 percent calculated for near-surface and subsurface samples. This discrepancy is because a single location shown on the figure may reflect several samples at multiple depths. If any of these results exceeds the HPAL, the figure will show a red dot at that location. These results indicate elevated concentrations of lead in soils at Parcel D, with higher concentrations detected in shallower soils. Based on the results of the HHRA, remedial action is planned to address lead in soil at concentrations above remediation goals.

Manganese

Manganese is a naturally occurring metal associated with bedrock of the Hunters Point Shear Zone. Figures 2-23 and 2-24 show analytical results for manganese in soil samples at Parcel D

collected from the near-surface and the subsurface, respectively. Manganese was detected at a frequency of greater than 99 percent at both depth intervals (see Tables 2-6 and 2-7). These frequencies of detections in both depth intervals indicate that manganese is ubiquitous with a widespread distribution of this metal at Parcel D. About 17 percent of the detected manganese results in the near-surface depth interval and about 9.5 percent of the detected manganese results in the subsurface depth interval exceeded the HPAL (see Tables 2-6 and 2-7). These results indicate elevated concentrations of manganese in soils at Parcel D, with higher concentrations detected in shallower soils. Although Figures 2-23 and 2-24 indicate some areas with a group of samples showing manganese concentrations exceeding the HPAL, these areas do not correlate with potential unacceptable risk areas based on exposure to this metal. In addition, the concentrations and associated sampling locations do not appear related to a release from previous industrial activities at Parcel D. However, based on the results of the HHRA, remedial action is planned to address manganese in soil above remediation goals.

2.5.1.2 Characterization of VOCs in Soil

Soil samples have been collected and analyzed for 68 individual VOCs at Parcel D. Table 2-8 presents the statistical information for each VOC for soil samples that were collected from the near-surface; Table 2-9 presents the statistical information for each VOC for soil samples collected from the subsurface. These tables show the frequencies of detection for each analyte. Forty of the 68 VOCs were consistently not detected for both depth intervals, and only 26 of the 68 VOCs were detected in one or more samples from either of the depth intervals.

Toluene was detected at the greatest frequency of approximately 13 percent for soil samples collected from the near-surface (see Table 2-8). None of the other VOCs in near-surface soils was detected at a frequency greater than 7 percent. The maximum detected concentration of VOCs for all of the soil samples in the near-surface was total xylenes, at 3 mg/kg.

Carbon disulfide was detected at the greatest frequency of approximately 13 percent for soil samples collected from the subsurface (see Table 2-9). None of the other VOCs in subsurface soils was detected at a frequency above 6 percent. The maximum detected concentration of VOCs for all of the soil samples in the subsurface was naphthalene, at 0.68 mg/kg.

The impacts of xylenes and naphthalene are most likely from releases of fuel products because both VOCs are common constituents of petroleum fuel products. As previously discussed, several TCRAs have removed and disposed of petroleum and petroleum-related releases in Parcel D. The maximum detected concentrations of these VOCs are low and represent residual concentrations.

The analytical data for VOCs in all soil samples collected from near-surface depths are used in the revised HHRA presented in Section 3.0. Results of the revised HHRA concluded that none of the VOCs present in soil are COCs; therefore, no further discussion of VOCs in soil is needed to assess remedial alternatives in this revised Parcel D FS report.

2.5.1.3 Characterization of SVOCs in Soil

Soil samples were collected and analyzed for 65 individual SVOCs at Parcel D. Table 2-10 presents the statistical information for each of the SVOCs for soil samples that were collected from the near-surface; Table 2-11 presents the statistical information for each of the SVOCs for soil samples collected from the subsurface. These tables show the frequency of detection for each analyte. Thirty-five of the 65 SVOCs were not detected in soil samples from either depth, leaving only 30 of the 65 SVOCs that were detected in 1 or more sample from either of the depths.

Benzo(b)fluoranthene, chrysene, fluoranthene, phenanthrene, and pyrene were the only SVOCs detected at a frequency greater than 10 percent for soil samples collected from the near-surface (see Table 2-10). The maximum detected concentration of an SVOC for all of the soil samples from the near-surface was bis(2-ethylhexyl)phthalate, at 18 mg/kg.

Only benzo(a)pyrene, fluoranthene, phenanthrene, and pyrene were detected at frequencies greater than 10 percent for soil samples collected from the subsurface (see Table 2-11). The maximum detected concentration for all of the soil samples from the subsurface was pyrene at 13 mg/kg.

The analytical data for SVOCs for all soil samples collected from near-surface depths are used in the revised HHRA presented in Section 3.0. Results of the revised HHRA identified two COCs: benzo(a)pyrene and benzo(b)fluoranthene that contribute the greatest percentage of risk from the SVOC analyte group.

The calculated acceptable risk for an individual SVOC based on the HHRA results for Parcel D is often less than the minimum detection limit reported from the laboratory using standard EPA analytical methods. Therefore, figures and tables prepared for this section show PAH concentrations that exceeded the laboratory reporting limit of 0.33 mg/kg in soils as a screening level, although qualified concentrations of these chemicals below the laboratory reporting limit are reported and shown on the figures as detections. Figures 2-25 and 2-26 presents the distribution of detected benzo(a)pyrene at the two depth intervals, and also shows the distribution of this PAH above the laboratory reporting limit. Figures 2-27 and 2-28 presents the distribution of detected benzo(b)fluoranthene at the two depth intervals, and also shows the distribution of this PAH above the laboratory reporting limit. These two SVOCs are further discussed because they are the main risk drivers from the HHRA for the chemical group of SVOCs.

Benzo(a)pyrene

Table 2-10 and 2-11 show similar frequencies of detections of benzo(a)pyrene in near-surface and subsurface soil, at 7.66 percent and 10.46 percent, respectively. Similarly, the maximum concentrations of this PAH are nearly the same, at 4.1 and 4.2 mg/kg in the two soil intervals. These data indicate a similar concentration of benzo(a)pyrene in both the near-surface and subsurface soils at Parcel D.

Figures 2-25 and 2-26 represent the distribution of benzo(a)pyrene in the two soil depth intervals. These maps show that concentrations of this PAH above the laboratory reporting limit of 0.33 mg/kg occur at sites IR-16, IR-17, IR-33 north, IR-35, IR-44, and IR-55; however, further evaluations of benzo(a)pyrene in the HHRA (see Section 3.0 and Appendix B) indicate that concentrations of this PAH are also a risk to human health at sites IR-34 and IR-70. These areas may be associated with releases of PAHs, including benzo(a)pyrene, from the activities at the facility.

Benzo(b)fluoranthene

Tables 2-10 and 2-11 show similar frequencies of detections for benzo(b)fluoranthene in near-surface and subsurface soil, at 10.03 percent and 8.87 percent, respectively. The maximum concentrations of this PAH in the two soil intervals are 13 and 1.7 mg/kg, respectively.

Figures 2-27 and 2-28 represent the distribution of benzo(b)fluoranthene in the two soil depth intervals. These maps show concentrations of this PAH above the laboratory reporting limit of 0.33 mg/kg that are a risk to human health (see Section 3.0 and Appendix B) at sites IR-16, IR-17, IR-33 North, IR-33 South, IR-34, IR-35, IR-44, and near IR-55. These areas may be associated with releases of PAHs, including benzo(b)fluoranthene, from the activities at the facility.

2.5.1.4 Characterization of Pesticides, PCBs, and Cyanide in Soil

Soil samples were collected and analyzed for 21 individual pesticides, 7 PCBs, and cyanide at Parcel D. Table 2-12 presents the statistical information for pesticides, PCBs, and cyanide in soil samples collected from the near-surface. Table 2-13 presents the statistical information for each of these analytes in soil samples collected from the subsurface. Five of the 29 analytes were not detected in samples from either depth interval, leaving 24 analytes that were detected in 1 or more samples from either depth interval.

The PCB Aroclor-1260 and cyanide were the only analytes detected in near-surface soil samples at frequencies greater than 10 percent (see Table 2-12). Eight pesticides were detected at a frequency greater than 1 percent but less than 5 percent. The maximum detected concentrations of analytes for all of the soil samples in the near-surface were for Aroclor-1260, at 0.98 mg/kg, and cyanide at 2.2 mg/kg.

None of the pesticide or PCB analytes were detected at a frequency of greater than 1 percent for soil samples collected from the subsurface (see Table 2-13). Cyanide was detected at a frequency of less than 9 percent. The maximum detected concentration of these analytes in the subsurface was the concentration of the PCB Aroclor-1254, at 0.871 mg/kg. These differences in the detection frequencies and maximum concentrations between the two depth intervals indicate that these analytes were primarily released to near-surface soils and that they are relatively immobile.

The analytical data for pesticides, PCBs, and cyanide for all soil samples collected from the near-surface are used in the revised HHRA presented in Section 3.0. Results of the revised HHRA concluded that none of the pesticides, PCBs, or cyanide present in soil are COCs; therefore, no further discussion of pesticides, PCBs, or cyanide in soil is needed to assess remedial alternatives in this revised FS report.

2.5.2 Parcel D Groundwater Characterization

The following sections briefly discuss the analytical groups for which groundwater was analyzed: metals, VOCs, SVOCs, pesticides and PCBs, dioxins, radionuclide isotopes, total petroleum hydrocarbons (TPH), and groundwater quality parameters. For each analytical group, data summary tables list for the A-aquifer and B-aquifer various statistics, including percent detected, average concentration, and the standard deviation. The percent detected shows the frequency at which the analyte is detected. Tables 2-14 through 2-21 present the statistical data for the A-aquifer, and Tables 2-22, 2-23, and 2-24 present the statistical data for the B-aquifer. Standard deviation is a statistic that shows the variability of the data; a large standard deviation indicates that the data values differ greatly from the mean, and a small standard deviation indicates that they do not vary greatly from the mean.

The groundwater characterization in this section will only discuss the degree and extent of COCs that present a potential unacceptable risk at Parcel D in the A-aquifer. This COC list is based on those analytes from either the revised HHRA (see Section 3.1 and Appendix B) or from a screening-level evaluation with surface water criteria (see Section 3.2) that identify chemicals that pose a potential unacceptable risk to human health or a threat to the Bay.

The B-aquifer has a limited areal extent in Parcel D, as shown on Figure 2-12. The cross-section in Figure 2-7 shows the B-aquifer is separated from the A-aquifer by 25 to 45 feet of Bay Mud consisting of clay and sandy clay. Only a limited number of samples have been collected through 2004 from the three B-aquifer monitor wells that are installed at Parcel D. No remedial actions are required for the B-aquifer based on (1) the existing analytical results that show no impacts to the B-aquifer groundwater at Parcel D, and (2) the protection provided by the thick aquitard that separates the A-aquifer and the B-aquifer.

2.5.2.1 Characterization of Metals in Groundwater

Groundwater samples were collected and analyzed for 26 individual metals at Parcel D. Table 2-14 presents the statistical information for each of these metals for groundwater samples collected from the A-aquifer, and Table 2-22 presents the statistical information for the metals for B-aquifer. Results of the revised HHRA concluded that none of the metals in groundwater from either the A-aquifer or the B-aquifer are a HHRA COC; therefore, no further evaluation of metals in groundwater is needed in this revised FS report with regards to human health risk.

Chromium VI and nickel were identified as potential ecological COCs in the A-aquifer based on the surface water criteria screening (see Section 3.2). Figure 2-29 shows the extent of the

chromium VI groundwater contamination based on the June 2004 data, and the extent of the nickel contamination based on the February 2001 data. These data are the most recent results used in the data set for this revised FS report for the wells that showed elevated concentrations of these two COCs.

Chromium VI is found as a plume defined by five wells in the northwestern portion of Parcel D. Four of these wells were sampled in June 2004, and the other well in this plume (IR09PPY1) was sampled in February 2001. IR09PPY1 was sampled again in 2005, 2006 and 2007; these recent data are provided on Figure 2-29. All of the wells within this plume have a history of consistent detectable concentrations of chromium VI. This metal is also consistently detected in samples from well IR09MW35A at the northwest corner of Building 411, and in samples collected from well IR33MW61A, just east of Building 304.

Nickel is consistently found at elevated concentrations in samples collected from well IR09P043A, located within Building 411 near the northwest corner of the building. Nickel is a naturally occurring metal in the groundwater at HPS: however, the elevated concentrations of nickel at this location may indicate a release that has impacted groundwater, and may be associated with the same source as the chromium VI impacts to the groundwater.

2.5.2.2 Characterization of VOCs in Groundwater

Groundwater samples were collected and analyzed for 57 individual VOC analytes at Parcel D. Table 2-15 presents the statistical information for each of the VOCs for groundwater samples collected from the A-aquifer, and Table 2-23 presents the statistical information for the B-aquifer. These tables also list frequencies of detection for each of the VOCs.

Thirty-three of the VOCs were not detected in groundwater samples from the A-aquifer. The remaining 24 VOCs were detected in less than 10 percent of the samples, except for chloroform, which was detected in approximately 16 percent of the samples, methane, which was detected in approximately 45 percent of the samples, and tert-butyl methyl ether, which was detected in approximately 12 percent of the samples, although the latter two analytes were sampled fewer times. None of the VOCs were reported at concentrations greater than the surface water criteria; therefore, there are no VOCs that are considered COC from the surface water screening.

Only three VOCs were detected in groundwater samples from the B-aquifer. Although the number of samples analyzed for VOCs from the B-aquifer is small, the few number of detections and the low concentrations of the analytes detected did not warrant further sampling and analyses of groundwater from the B-aquifer at Parcel D. None of the VOCs detected in the B-aquifer presented a human health risk (see Section 3.1) or were reported at concentrations greater than the surface water criteria (see Section 3.2). As a result, no VOCs in the B-aquifer are considered COCs.

All of the VOCs detected in groundwater A-aquifer and the B-aquifer were evaluated in the revised HHRA. Eight VOCs were identified as COCs in the A-aquifer: chloroform, methylene

chloride, tetrachloroethene, trichloroethene, benzene, carbon tetrachloride, naphthalene, and total xylenes. Of the eight identified COCs, only chloroform, tetrachloroethene, and trichloroethene were detected during the most recent groundwater sampling event.

Figure 2-30 shows the present-day VOC contamination in the A-aquifer groundwater at Parcel D and lists the concentrations of the three COCs detected in June 2004. Three VOC plumes have been identified, the IR-09 VOC plume, the IR-71 eastern VOC plume, and a single well VOC plume (IR44MW08A) at IR-71 western VOC plume.

The plume near monitoring well IR09MW51F is within the northern plume of chromium VI at IR-09. This VOC plume is much smaller than the plume of chromium VI and contains the COCs trichloroethene and chloroform. The IR-71 eastern VOC plume that includes wells IR70MW04A and IR71MW03A is primarily chloroform, with tetrachloroethene and trichloroethene detected only in samples from well IR71MW03A. The single well IR-71 western plume at IR44MW08A contains trichloroethene and chloroform. These two IR-71 plumes appear to be separate and stable based on all of the data from analysis of groundwater from these plume wells and from monitoring well IR33MW63A, which is between these two plumes. Well IR33MW63A has had no detectable concentrations of any of the VOCs in any groundwater samples; however, IR33MW63A has not been sampled since March 1996. The data from the plume wells and other nearby wells show little change in the plumes concentrations or locations. Based on the plume's apparent stability, and on the historical data from well IR33MW63A, it is not likely that the two plumes at IR-71 are connected.

Only the most recent groundwater data in the FS data set were evaluated in considering potential remedies. At the time of the RD, the data for the 12 most recent samples from wells that are included in the remediation will be reviewed to finalize the remedy. In addition, data from new wells (installed after 2004) will be evaluated. For example, the Navy is planning a treatability study at IR-09 that will include installing wells north of well IR09MW51F (Allied Group Joint Venture 2007).

2.5.2.3 Characterization of SVOCs in Groundwater

Groundwater samples were collected and analyzed for 67 individual SVOCs at Parcel D. Table 2-16 presents the statistical information for each of the SVOCs for groundwater samples collected from the A-aquifer. This table also lists the frequency of detection for each of the SVOCs.

Forty-six of the SVOCs were not detected in any of the groundwater samples. Eleven of the SVOCs were detected at frequencies of less than 1 percent, and the remaining 10 detected SVOCs were detected at a frequency between 1 percent and 5 percent.

All of the SVOCs detected in groundwater were evaluated in the revised HHRA. Results of the revised HHRA concluded that none of the SVOCs present in groundwater are a COC. In addition, no COCs were identified based on the surface water criteria evaluation

(see Section 3.2). Because no SVOCs were identified as COCs from the surface water criteria screening, no further discussion of SVOCs in groundwater is needed to assess remedial alternatives in this revised FS report.

2.5.2.4 Characterization of Pesticides, PCBs, and Cyanide in Groundwater

Groundwater samples were collected and analyzed for 21 individual pesticides, 7 PCBs, and cyanide at Parcel D. Table 2-17 presents the statistical information for each of these analytes for groundwater samples collected from the A-aquifer. This table also lists the frequency of detection for each of the analytes.

Because no chemicals from these analyte groups were identified as COCs, no further discussion of pesticides or PCBs in groundwater is needed to assess remedial alternatives in this revised FS report.

Cyanide was detected in a grab groundwater sample at IR-22. Results for grab groundwater samples from borings were not included in the groundwater statistics or in the HHRA, as the samples do not meet the required quality assurance criteria. Cyanide has not been detected in groundwater at groundwater monitoring wells at IR-22. However, further groundwater monitoring in this area will be recommended as part of the groundwater alternatives because of the proximity of the grab groundwater sample to the Bay.

2.5.2.5 Characterization of Dioxins and Furans in Groundwater

Groundwater samples were collected and analyzed for 26 individual dioxins and furans. Table 2-18 presents the statistical information for each of these chemicals dioxin for groundwater samples collected from the A-aquifer. This table also lists the frequency of detection for each of the analytes.

Only dibenzofuran and total tetrachlorodibenzofuran were detected in groundwater samples. Results of the revised HHRA concluded that dibenzofuran and tetrachlorodibenzofuran were not identified as COCs in groundwater at Parcel D. Because no chemicals from these analyte groups were identified as COCs, no discussion of dioxins or furans in groundwater is needed to assess remedial alternatives in this revised FS report.

2.5.2.6 Characterization of Radionuclide Isotopes in Groundwater

Groundwater samples were collected and analyzed for 45 individual radionuclide isotopes. Groundwater sampling for radionuclide isotopes focused on the areas identified with potential radioactive contamination. Table 2-19 presents the statistical information for each of these isotopes for groundwater samples collected from the A-aquifer. This table also lists the frequency of detection for each isotope.

Only 6 of the 45 radionuclide isotopes were detected (see Table 2-19). The following isotopes were detected in groundwater samples: americium-241, antimony-125, radium-226, radium-228, uranium 234, and uranium-238. The revised HHRA for groundwater (see Section 3.0) and the remedial alternatives presented in this revised FS report do not address radionuclide isotopes. The statistics for these isotopes are presented for information only. The Navy is conducting a separate program to address the radionuclide contamination.

2.5.2.7 Characterization of TPH in Groundwater

Groundwater samples were collected and analyzed for TPH and other petroleum hydrocarbon ranges by a variety of methods. Table 2-20 presents the statistical information for each of the reported petroleum ranges for groundwater samples collected from the A-aquifer. This table also lists the frequency of detection for each of the compounds.

Analytical results show no detections of TPH as extractable unknown hydrocarbons, TPH as JP5 aviation fuel, TPH as kerosene, or TPH as purgeable unknown hydrocarbons.

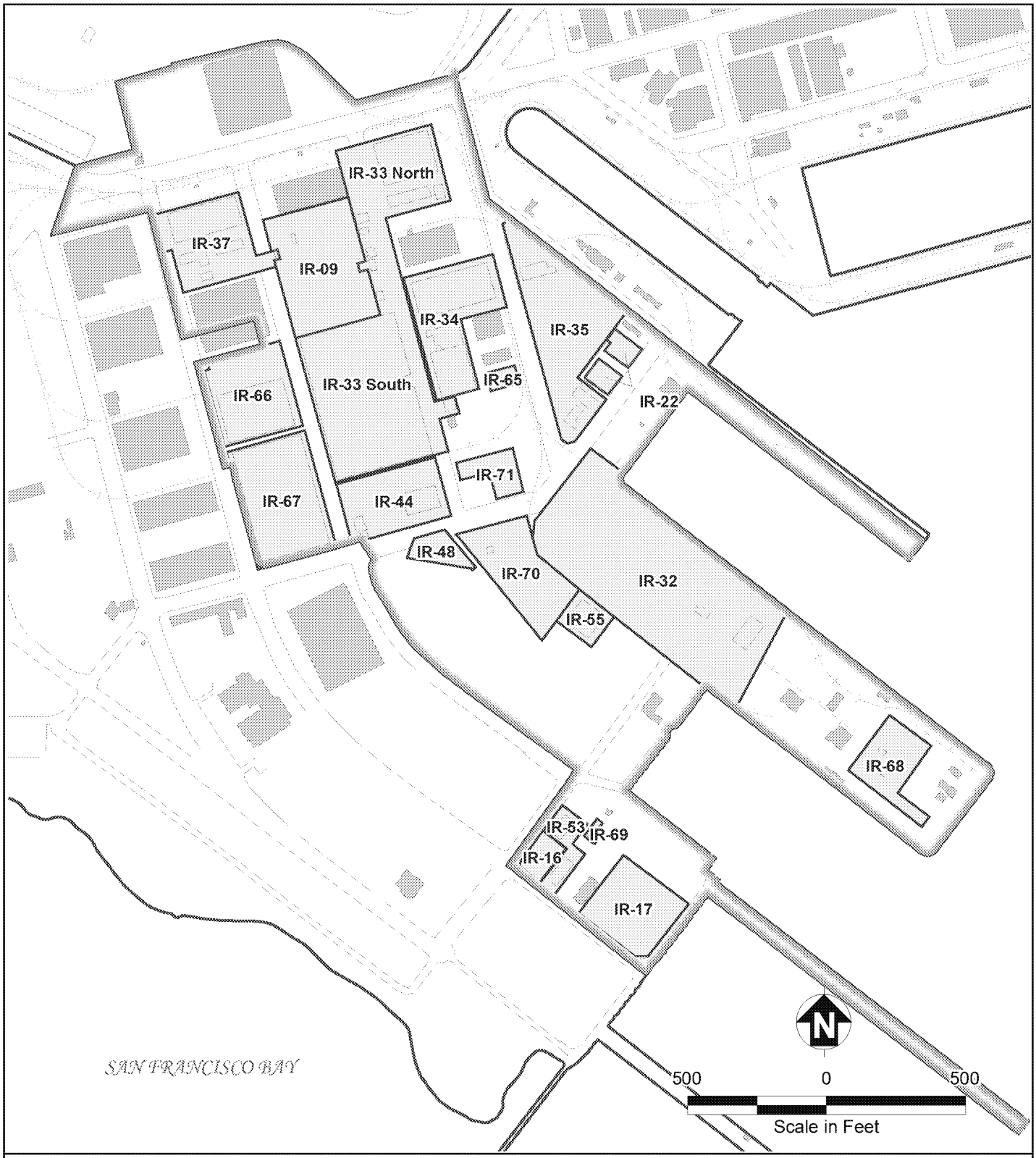
Petroleum hydrocarbon compounds are made up of many VOCs and SVOCs at varying ratios and different toxicities. Toxicity calculations and HHRAs are not commonly conducted for TPH ranges because they are a mixture of many analytes, and little or no data on the toxicity of such a mixture are known. In addition, these compounds naturally degrade and change in the environment, altering the mixture and making it difficult to analyze or predict the toxicity of a reported TPH range. However, nearly all of the samples that were analyzed for TPH were also analyzed for VOCs and SVOCs to measure the concentrations of individual constituents of the TPH compounds. These individual concentrations of VOCs and SVOCs were used in the revised HHRA (see Section 3.0) to account for the potential exposure of human receptors to petroleum compounds.

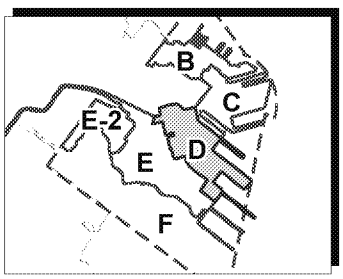
2.5.2.8 Characterization of Other Groundwater Characteristics

Groundwater samples were collected and analyzed for a variety of water quality characteristics. Table 2-21 presents the statistical information for each of these characteristics for groundwater samples collected from the A-aquifer, and Table 2-24 presents the statistical information for the B-aquifer. These data support the evaluation of beneficial use of the aquifers presented in Appendix D. In addition, groundwater characteristics may be important in evaluating certain types of groundwater remedies by identifying chemical constituents that may interfere with the remedial process such as sulfur compounds or TDS. None of these water quality characteristics are considered in the revised HHRA.

Elevated pH has been observed at one well at Parcel D. The pH readings at well IR33MW61A have exceeded 11 in four sampling events between 1996 and 2000. This elevated pH will be addressed in the groundwater alternatives.

FIGURES





Location Map

Parcel D IR Sites
Parcel D Boundary
Other Parcel Boundaries
Non-Navy Property
Building
Road

Note:
IR Installation Restoration

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FIGURE 2-1

PARCEL D IR SITES

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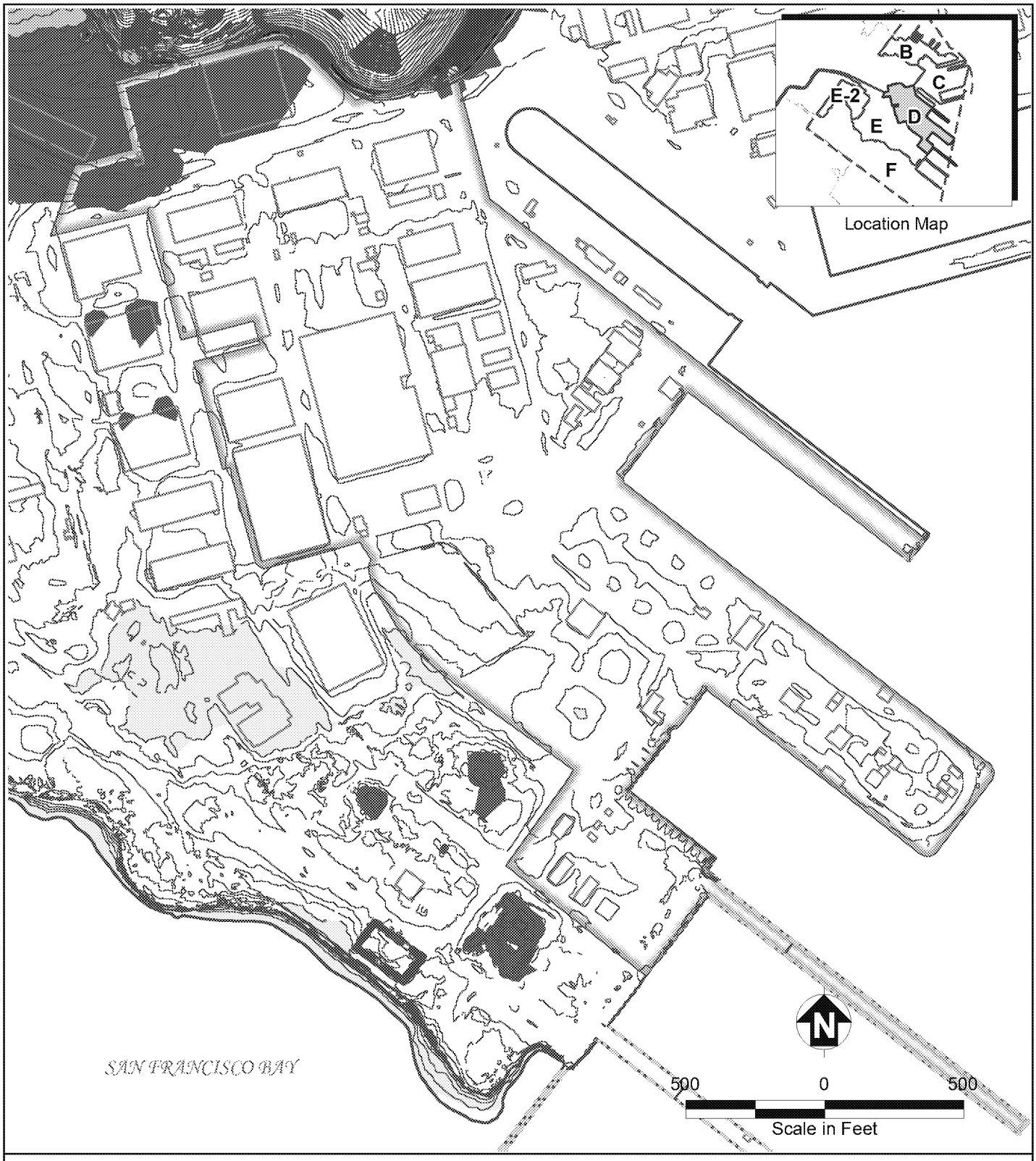
2007-10-15 V:\Hunters_Point\Projects\Parcel_D\FS_2005\Nature and Extent of Contamination\Parcel D IR Sites.mxd TtEMI-SF Kevin Ernst



Elevation Ranges (ft above msl)

- >50 ft
- 30-50 ft
- 25-30 ft
- 20-25 ft
- 15-20 ft
- 10-15 ft
- 5-10 ft
- 0-5 ft

Note:
msl Mean sea level

- Ground Surface Contours (1 Foot Interval)
- Areas with Underlying Water
- Parcel D Boundary
- Other Parcel Boundaries
- Building

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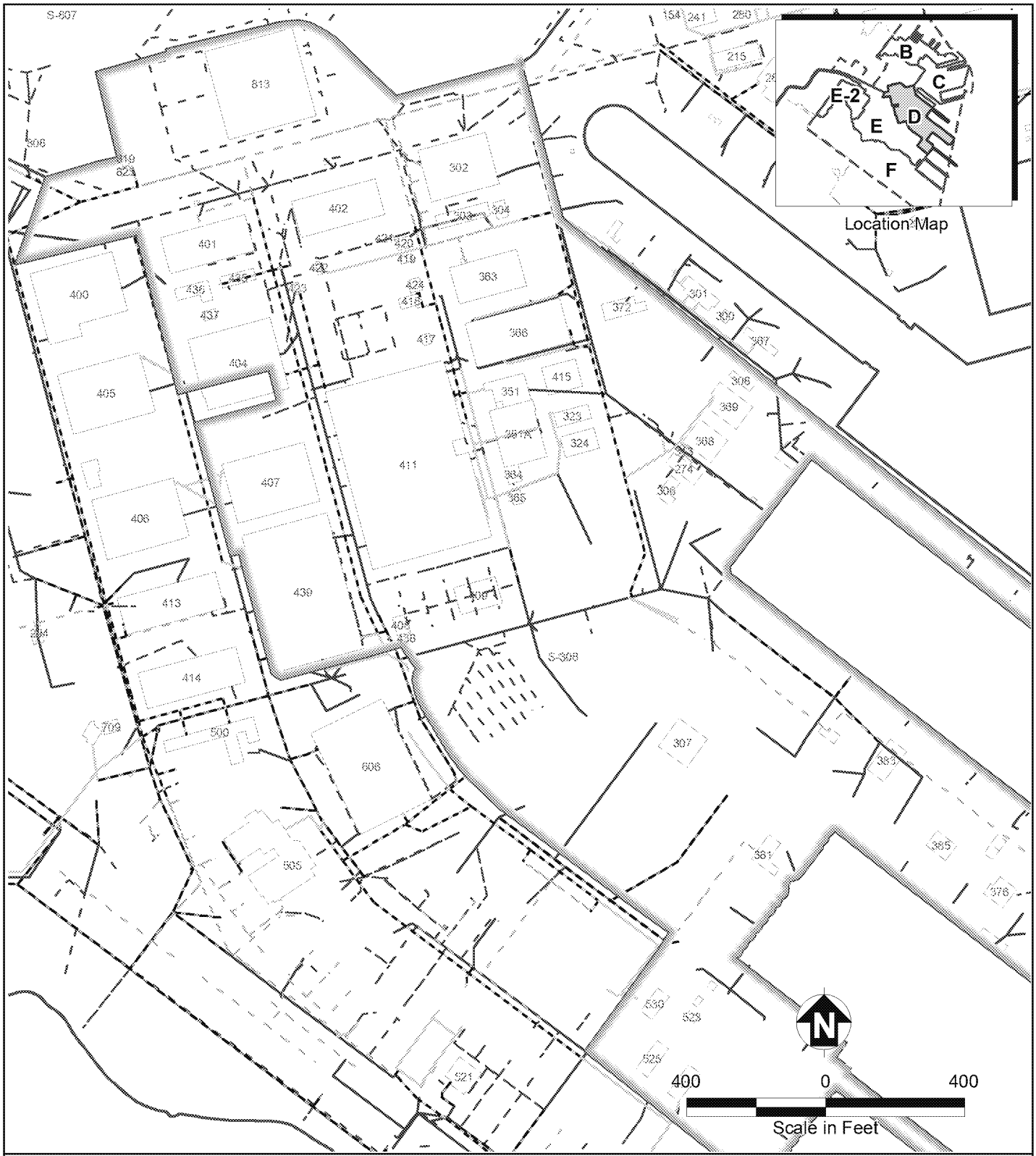
FIGURE 2-2

SURFACE TOPOGRAPHY AT PARCEL D

Revised Feasibility Study Report for Parcel D

2007-10-15 V:\Hunters_Point\Projects\Parcel_D\FS_2005\Nature and Extent of Contamination\Parcel D Topography.mxd TtEMI-SF Kevin Ernst



Sanitary Sewer Elevation Relative to Groundwater (June 2002)

- Above Groundwater
- Below Groundwater
- Unknown Elevation
- Parcel D Boundary
- Other Parcel Boundaries

Storm Drain Line Relative to Groundwater (June 2002)

- Above Groundwater
- Below Groundwater
- Unknown Elevation
- Building

Note: The Navy plans to remove the storm drain and sanitary sewer lines throughout most of HPS in 2006.

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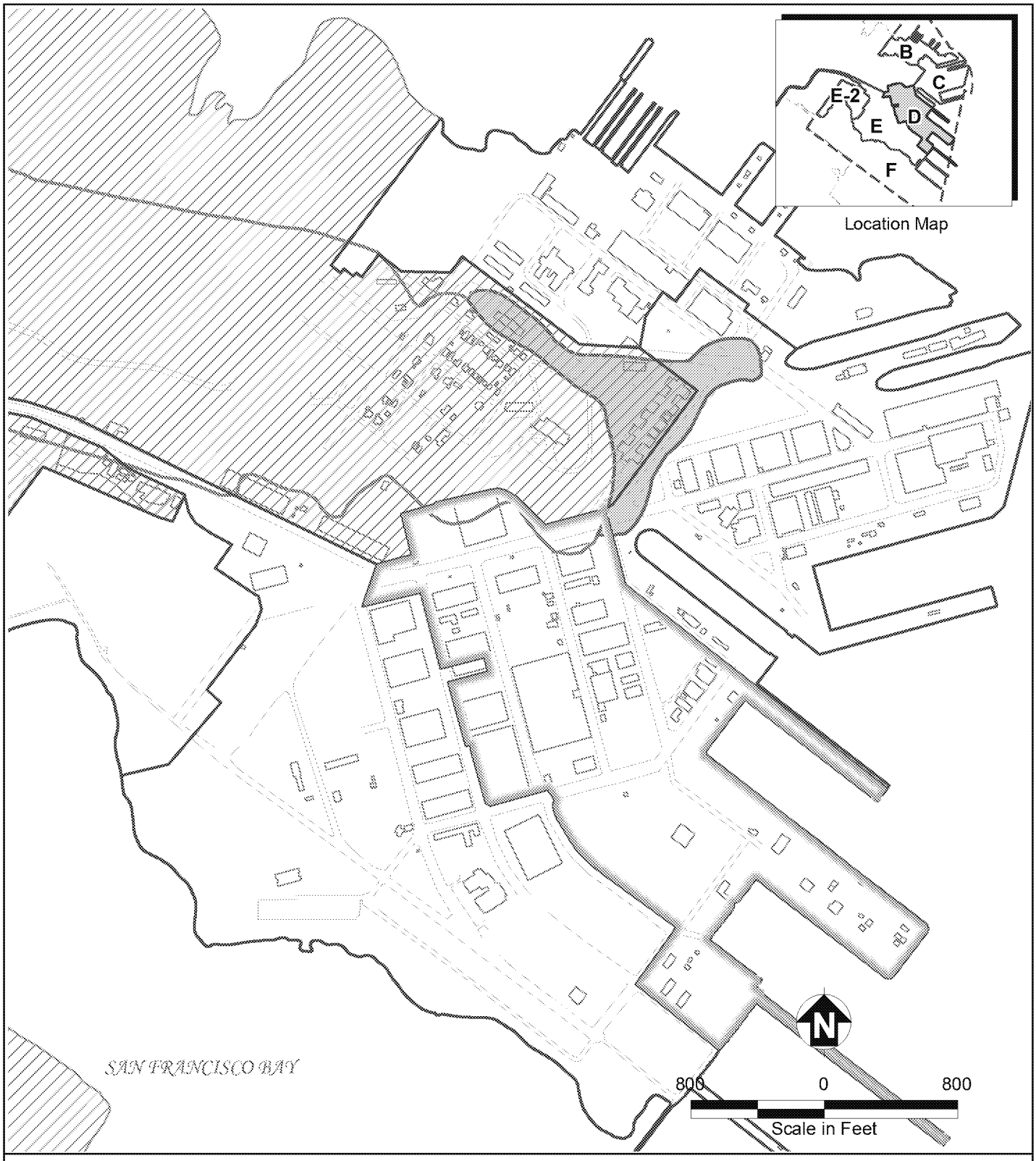
FIGURE 2-3

STORM DRAIN AND SANITARY SEWER LINE MAP

Revised Feasibility Study Report for Parcel D

2007-10-15 V:\Hunters_Point\Projects\Parcel_D\FS_2005\Nature and Extent of Contamination\Parcel D Storm_Sewer Lines.mxd TtEMI-SF Kevin Ernst



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Soil Types

- Orthents; cut and fill complex; 5-75% slopes
- Urban land
- Urban land to Orthents; reclaimed complex; 0-2%slopes
- Parcel D Boundary
- Other Parcel Boundaries
- Non-Navy Property
- Building
- Road

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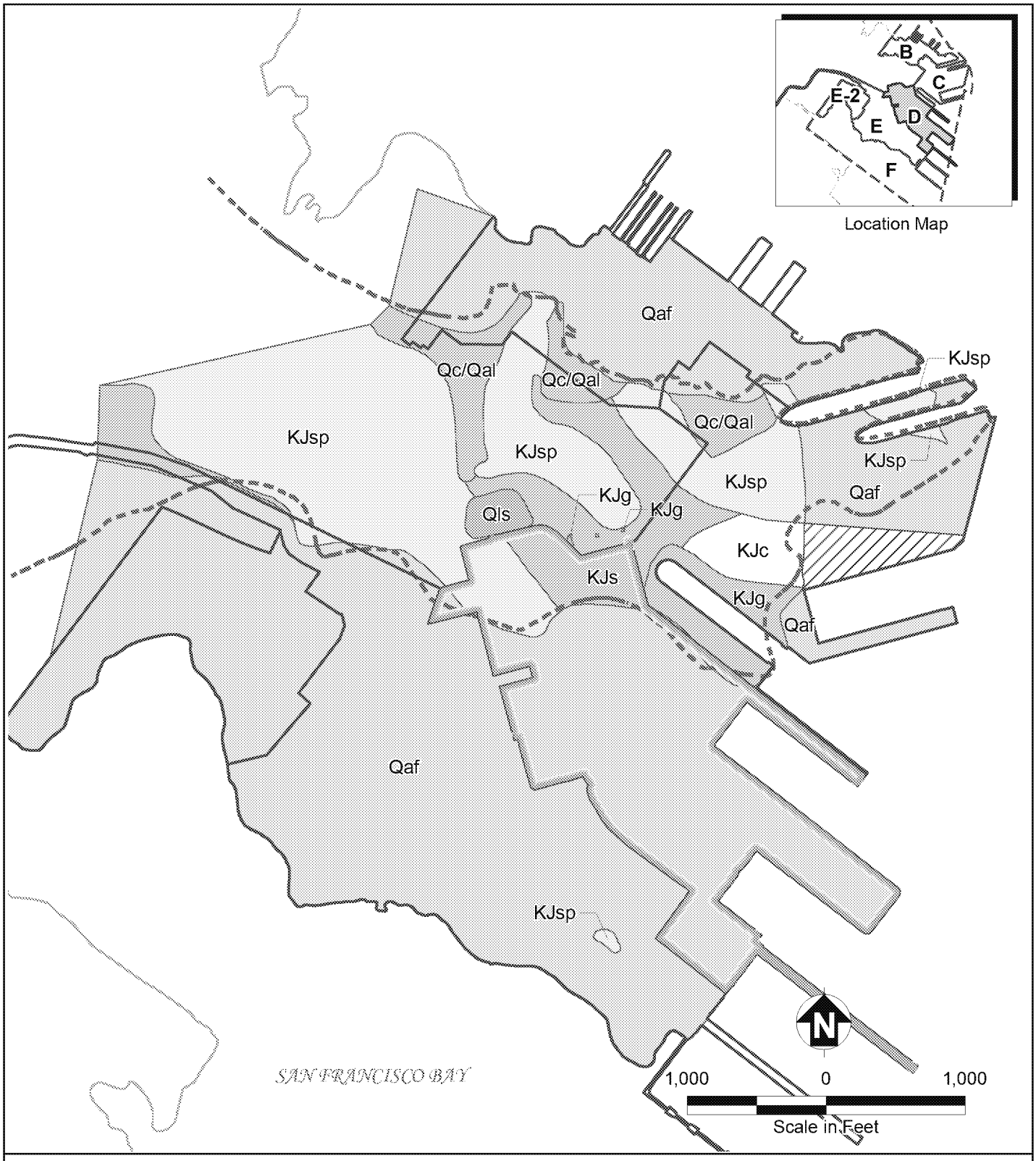
FIGURE 2-4

SOILS DISTRIBUTION MAP

Revised Feasibility Study Report for Parcel D

2007-10-15 V:\Hunters_Point\Projects\Parcel_D\FS_2005\Nature and Extent of Contamination\HPS Soils Distribution.mxd TIEMI-SF Kevin Ernst



Geologic Characterization

(Base on Bonilla 1971 and Schlocker 1974)

- KJc-Chert interbedded with shale
- KJg-Predominantly greenstone volcanic rock (Marin Headlands terrane)
- KJs-Undifferentiated sandstone and shale
- KJsp-Serpentinite
- Qaf-Fill material
- Qc/Qal-Colluvium/alluvium
- Qls-Landslide debris zone
- Geologic Contact (added by Tetra Tech [2001])
- 1935 Shoreline
- Parcel D Boundary
- Other Parcel Boundaries

Reference:

Bonilla, M.G. 1971. "Preliminary Geologic Map of the San Francisco South Quadrangle and Part of the Hunters Point Quadrangle." *U.S. Geological Survey Miscellaneous Field Studies Map.* MG-311. 1:24,000

Schlocker, J. 1974. "Geology of the San Francisco North Quadrangle, California." *U.S. Geological Survey Professional Paper 782.* Page 109.

Tetra Tech EM Inc. 2001. "Evaluation of Ambient Manganese Conditions, Hunters Point Shipyard, San Francisco, California."

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FIGURE 2-5

SURFICIAL GEOLOGY

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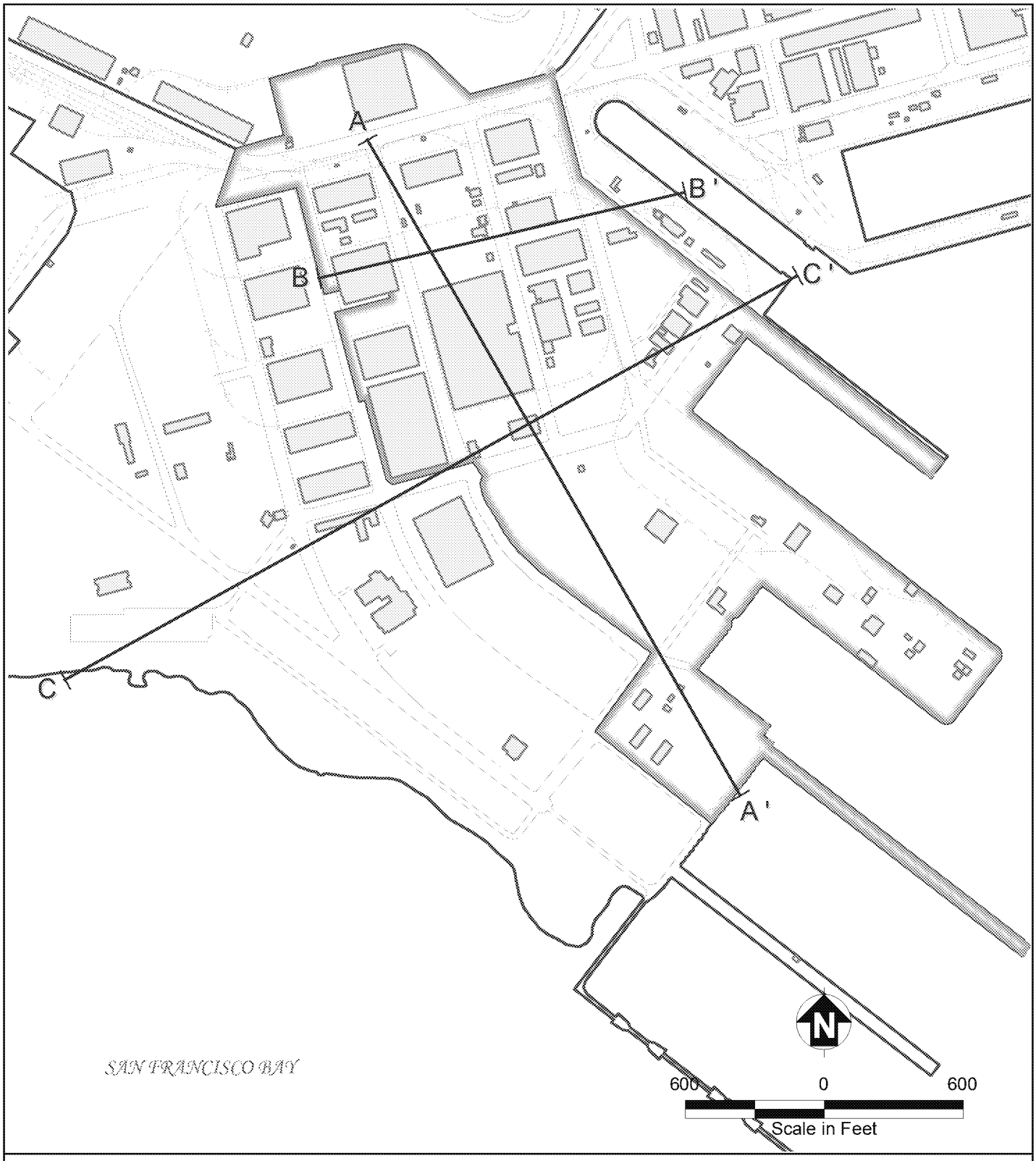
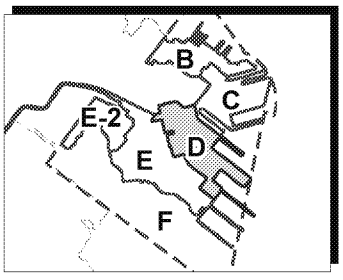
2007-10-15 V:\Hunters_Point\Projects\Parcel_D\FS_2005\Nature and Extent of Contamination\HPS Surficial Geology.mxd TtEMI-SF Kevin Ernst





Location Map

A A' Cross-Section Line

Parcel D Boundary

Other Parcel Boundaries

Non-Navy Property

Building

Road

Rail Line

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FIGURE 2-6

HYDROGEOLOGICAL CROSS-SECTION LOCATION MAP

Revised Feasibility Study Report for Parcel D

2007-10-15 V:\Hunters_Point\Projects\Parcel_D\FS_2005\Nature and Extent of Contamination\Cross-section locations.mxd TtEMI-SF Kevin Ernst

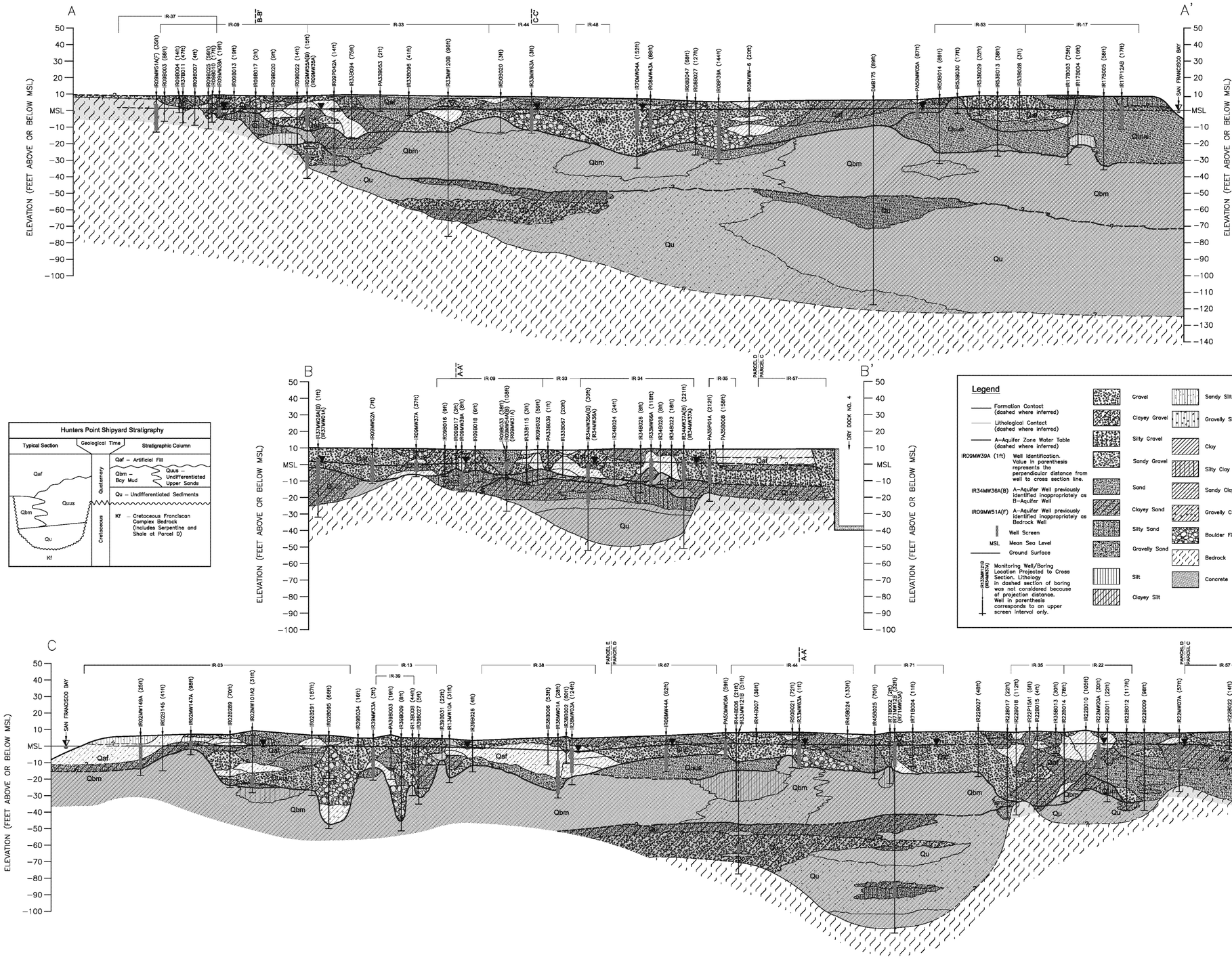

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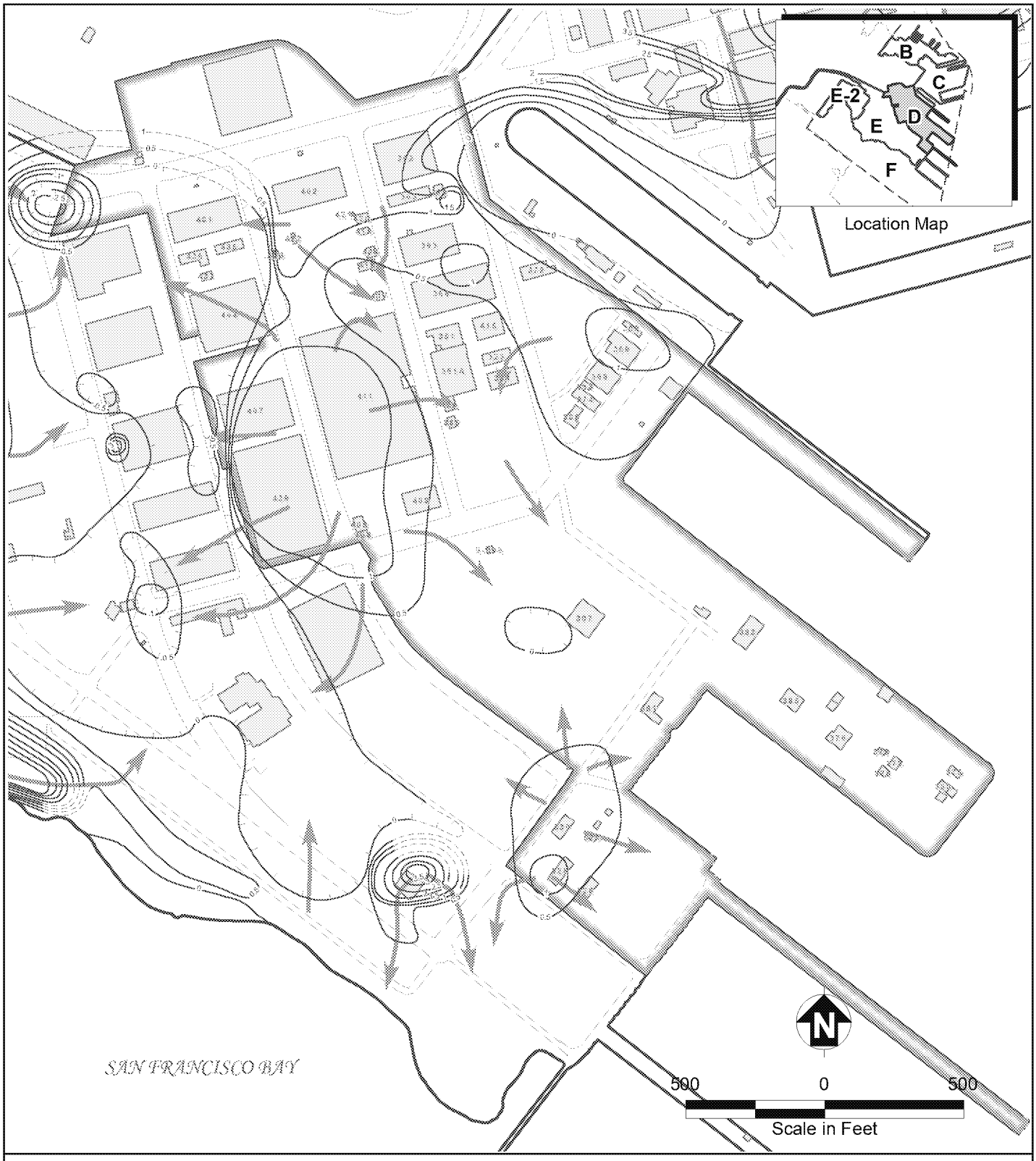
FIGURE 2-7

HYDROGEOLOGICAL CROSS SECTIONS A-A', B-B', AND C-C'

Draft Final Revised Feasibility Study for Parcel D



A-Aquifer Groundwater Contours (Phase III GDGI, February 2002; feet msl); dashed where inferred; hatched lines indicate depressions

A-Aquifer Flow Direction

Parcel D Boundary

Parcel Boundary

Non-Navy Property

Building

Note:
msl Mean sea level

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FIGURE 2-8
A-AQUIFER GROUNDWATER CONTOURS AT PARCEL D, 2002

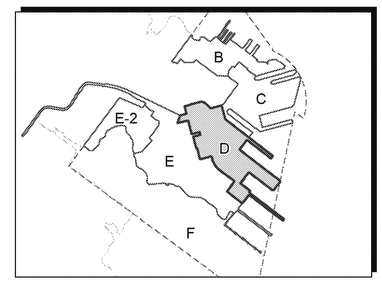
Revised Feasibility Study Report for Parcel D

2007-10-15 V:\Hunters_Point\Projects\Parcel_D\FS_2005\Nature and Extent of Contamination\A-Aquifer contours_Parcel D.mxd TtEMI-SF Kevin Ernst

Dry Dock 4

Southwest Shoreline

SAN FRANCISCO BAY



Location Map

Legend

- Monitoring well, showing well ID and groundwater elevation (feet relative to Mean Sea Level [ft MSL])
- * = not used in contouring
- Inferred groundwater potentiometric surface contour (ft MSL) dashed where uncertain, queried where unknown
- 1935 Shoreline
- Water supply line
- Storm drain line
- Sanitary sewer line
- Parcel E sheet pile wall
- Roads
- Parcel B Seawall
- Extent of Tidally Influenced Zone
- Buildings
- Area below Mean Sea Level
- Industrial landfill, final cover
- Parcel B
- Parcel C
- Parcel D
- Parcel E
- Parcel E-2
- Non - Navy property
- San Francisco Bay

NM: Not Measured

Note:
This figure was originally prepared as Plate 2 in "Parcel C, D, E and E-2 Quarterly Monitoring Report (January - March 2007) and Annual Report, Hunters Point Shipyard". CE2-Kleinfelder, June 2007

200 0 200 400
Scale in Feet

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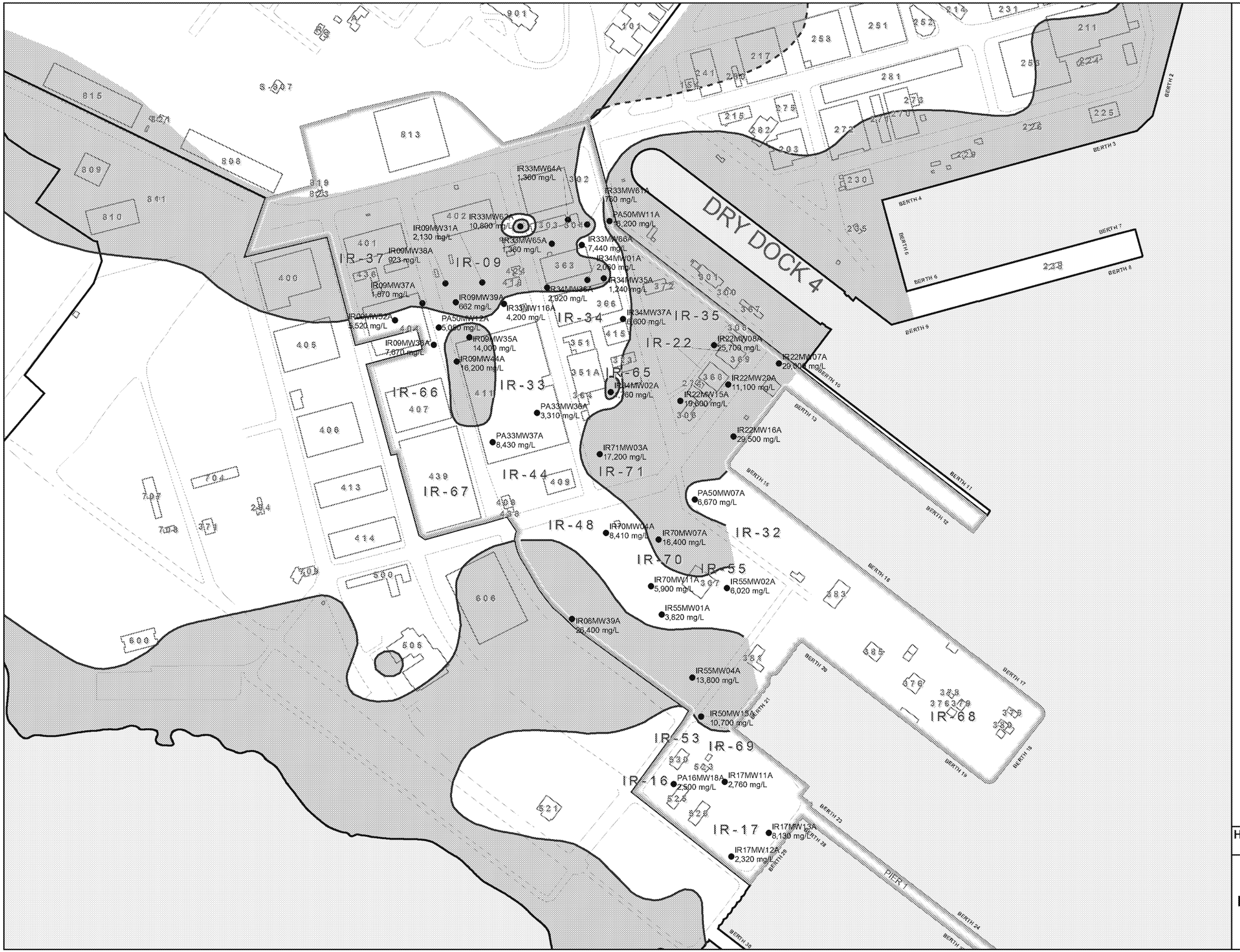
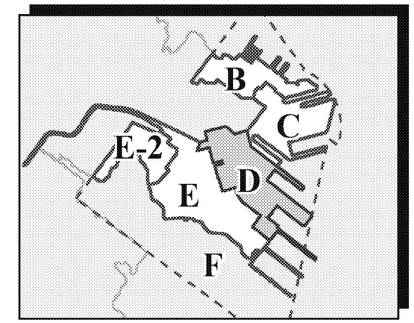
FIGURE 2-9

A-AQUIFER GROUNDWATER CONTOURS AT PARCEL D, MARCH 2007

Revised Feasibility Study Report for Parcel D

2007-10-15 V:\Hunters_Point\Projects\Parcel_D\FS_2005\Nature and Extent of Contamination\Updated_Kleinfelder_A-Aquifer contours_Parcel D.mxd TtEMI-SF Kevin Ernst





Location Map

- Monitoring Well with TDS Results

A-Aquifer TDS Zones

- ≥10,000 mg/L
- ≥3,000 mg/L and <10,000 mg/L
- <3,000 mg/L

TDS Concentration Contour Line

- Estimated
- Inferred
- Parcel D Boundary
- Other Parcel Boundaries
- Parcel D IR Sites
- Building
- Road

Notes:

≥	Equal to or greater than
<	Less than
IR	Installation Restoration
mg/L	Milligram per liter
TDS	Total dissolved solids

N

400 0 400

Scale in Feet

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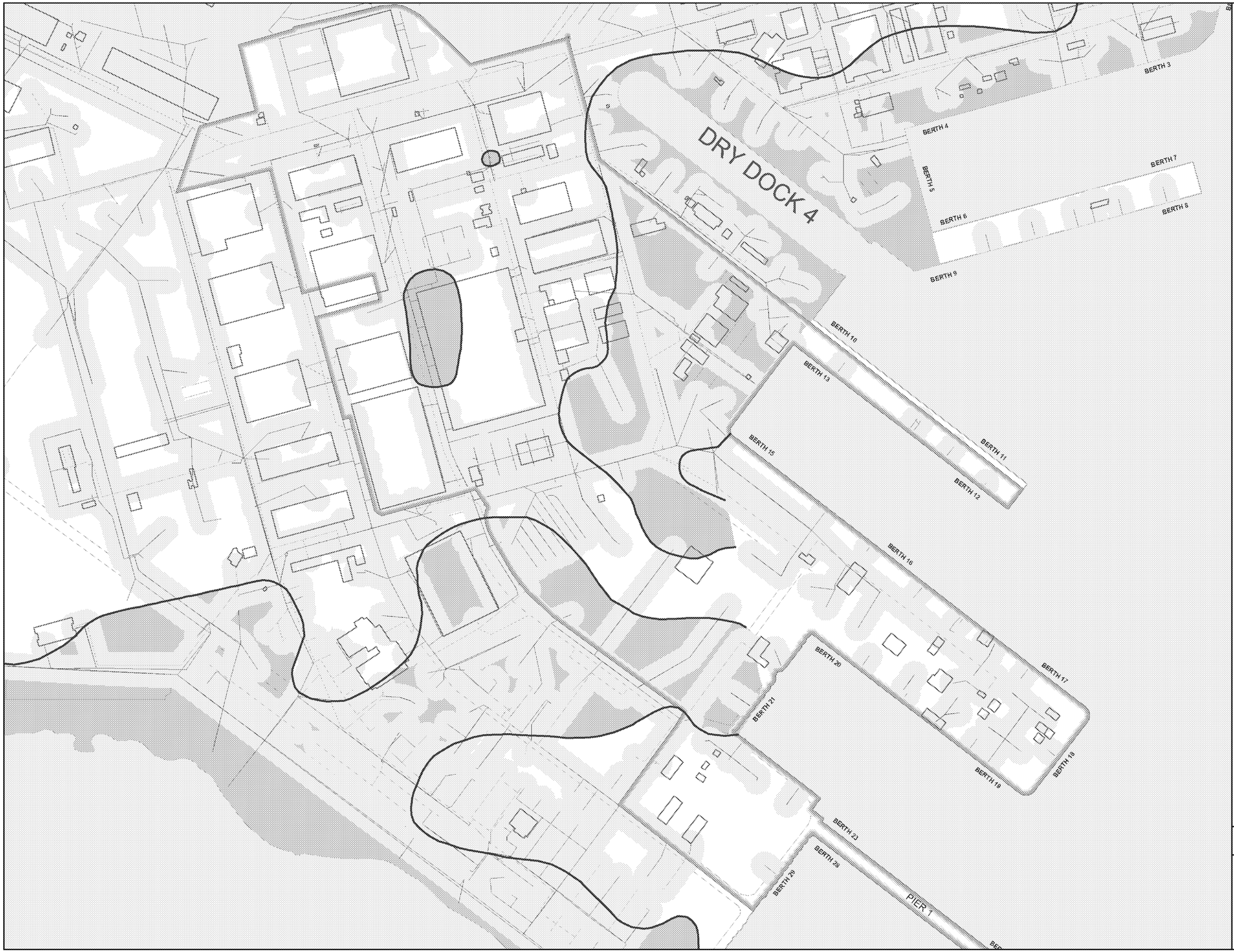
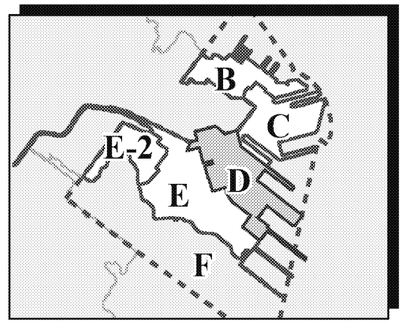
FIGURE 2-10

MAXIMUM TOTAL DISSOLVED SOLIDS IN THE A-AQUIFER

Revised Feasibility Study Report for Parcel D

2007-10-15 V:\Hunters_Point\Projects\Parcel_D\FS_2005\Nature and Extent of Contamination\Groundwater\parcel d_max TDS_a-aquifer.mxd TtEMI-SF Kevin Ernst





Location Map

- Sanitary Sewer Line
- Storm Line
- Areas Within 50 Feet of Sanitary Sewer or Storm Lines
- TDS ≥10,000 mg/L
- Parcel D Boundary
- Other Parcel Boundaries
- Non-Navy Property
- Building
- Road

Notes:

≥	Greater than or equal to
mg/L	Milligrams per liter
TDS	Total dissolved solids
UNKW	Unknown

N

350 0 350

Scale in Feet

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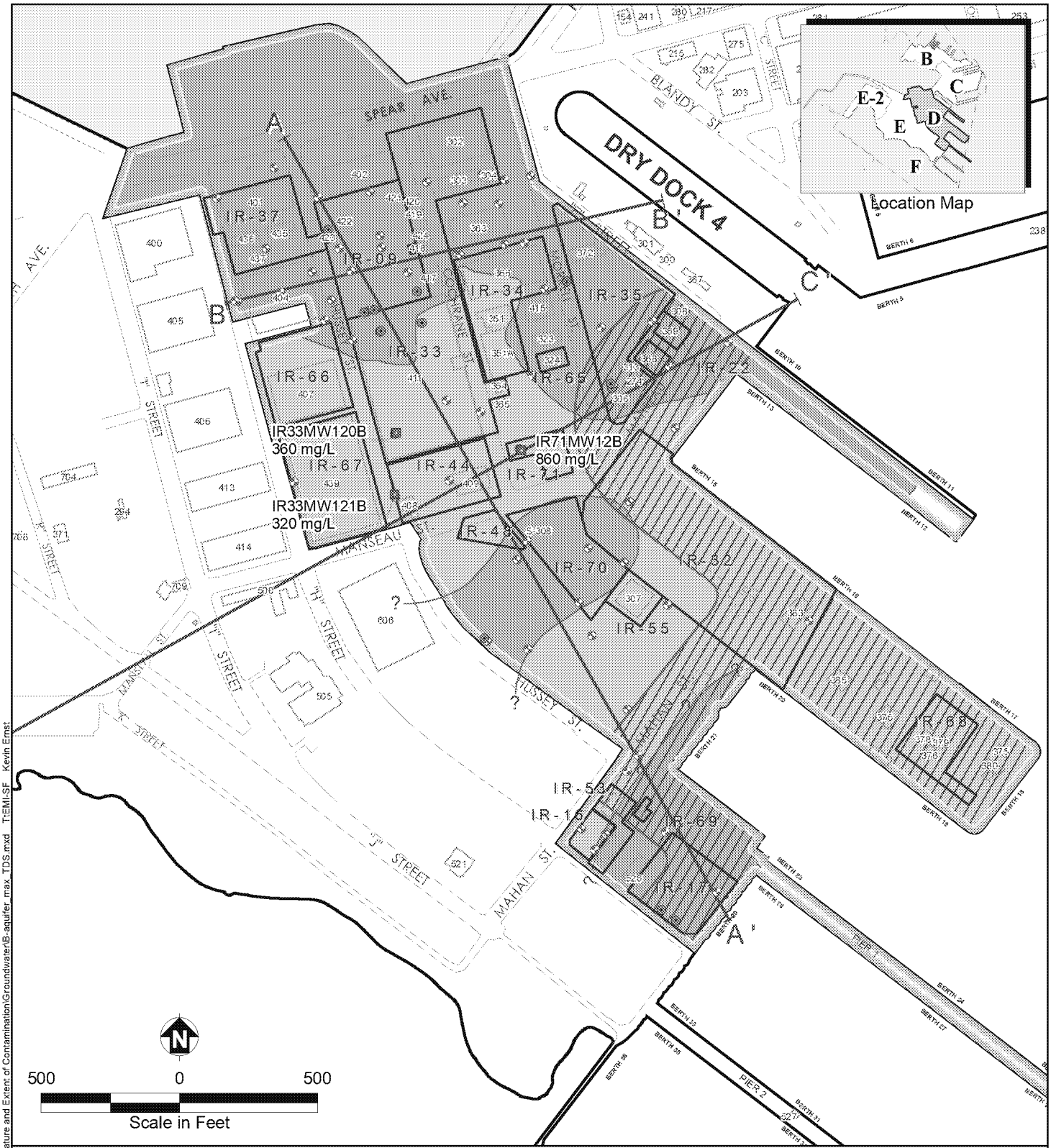
FIGURE 2-11
AREAL DISTRIBUTION OF FACTORS LIMITING DRINKING WATER BENEFICIAL USE OF A-AQUIFER GROUNDWATER PER FEDERAL CRITERIA

Revised Feasibility Study Report for Parcel D

2007-10-15 V:\Hunters_Point\Projects\Parcel_D\FS_2005\Nature and Extent of Contamination\Groundwater\beneficial use limits_parcel d.mxd TtEMI-SF Kevin Ernst



2005-11-28 V:\Hunters Point\Projects\Parcel D FS\Nature and Extent of Contamination\Groundwater\B-aquifer_max_TDS.mxd THEMI-SF Kevin Ernst

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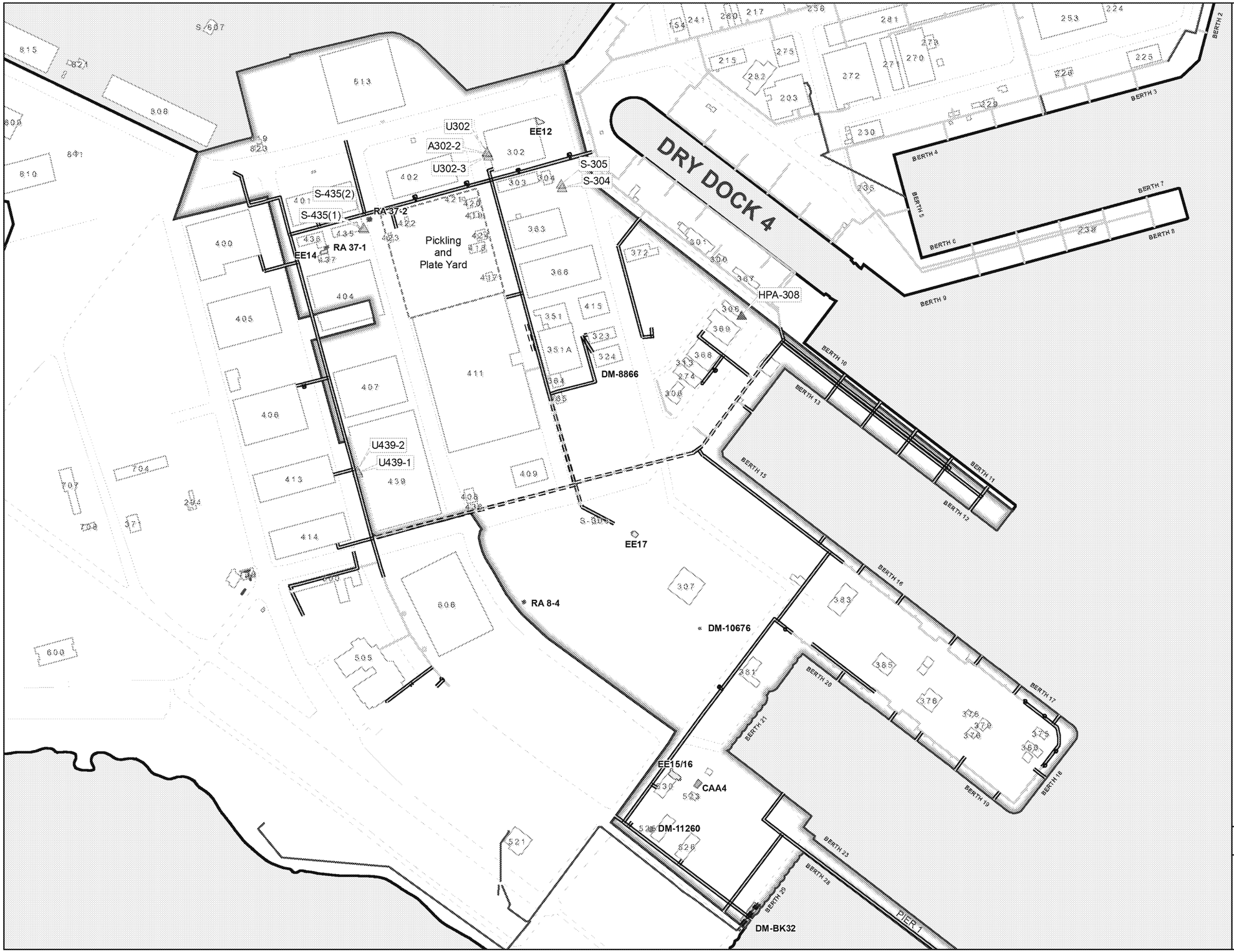
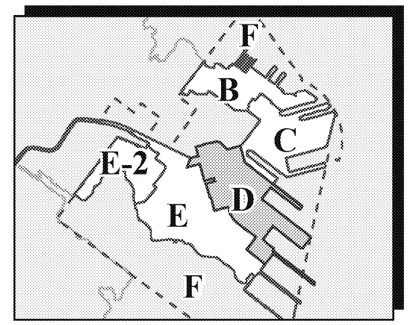
FIGURE 2-12

MAXIMUM TOTAL DISSOLVED SOLIDS IN THE B-AQUIFER

Revised Feasibility Study Report for Parcel D





Location Map

Former UST Locations

- Removed
- Closed in Place

Utility Line Status

- Removed
- Closed in Place
- Former Fuel Line
- Former Steam Line

Removal Actions

- Deminimus Areas
- Equipment Removal Action (1994)
- Exploratory Excavation (1996-1998)
- TCRA Excavations (2000-2001)
- TPH Corrective Action Area (2004)
- TCRA Excavation (2004)
- Parcel Boundary
- Other Parcels
- Non-Navy Property
- Building
- Road

400 0 400

Scale in Feet

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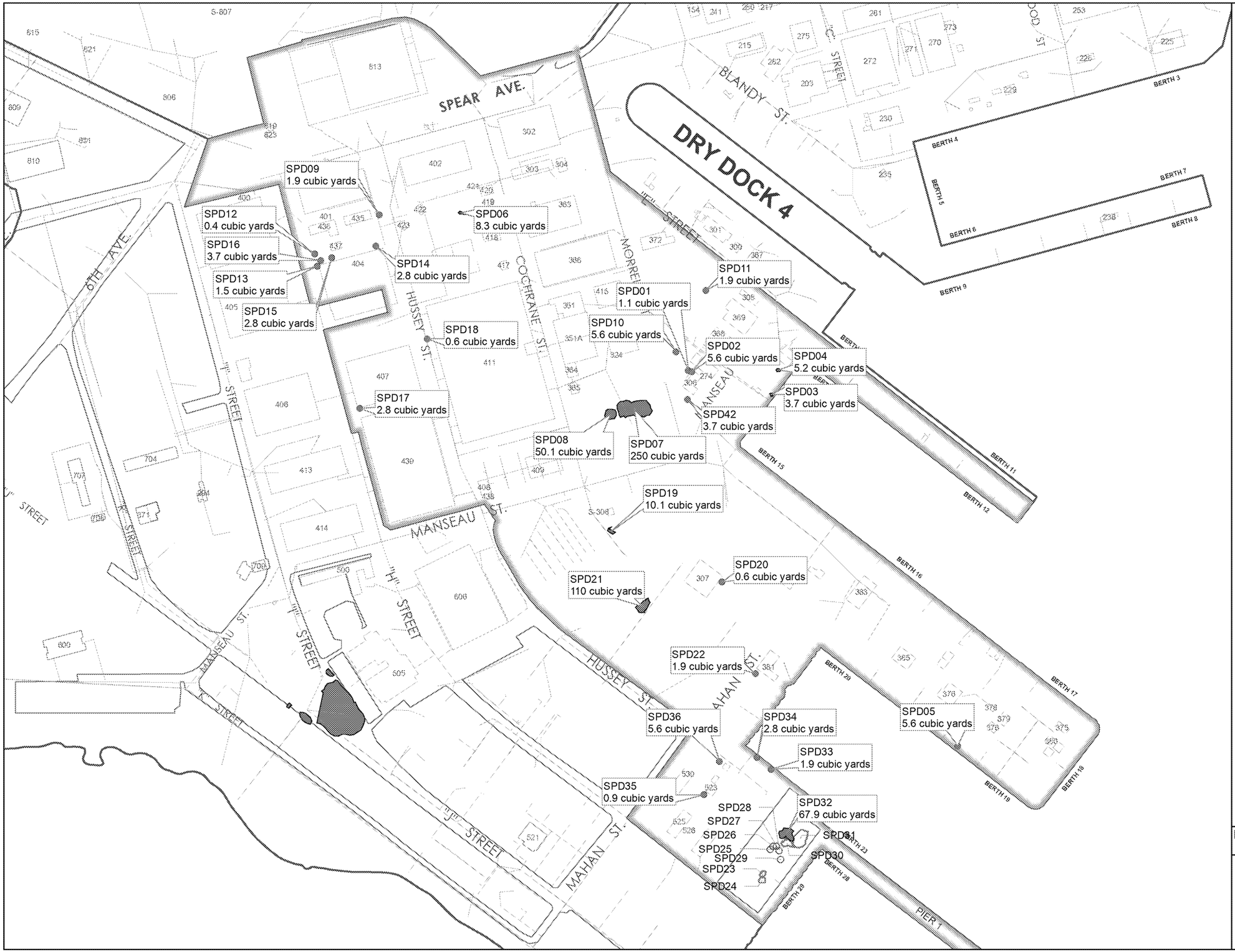
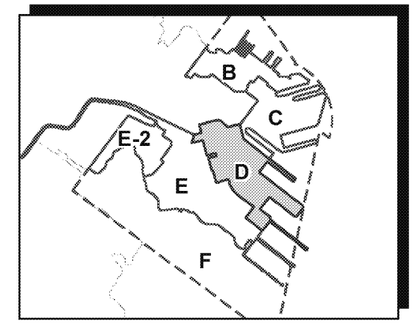
FIGURE 2-13

FORMER USTs, UTILITY LINES, AND REMOVAL ACTION AREAS MAP

Revised Feasibility Study Report for Parcel D

2007-10-15 V:\Hunters_Point\Projects\Parcel_D\FS_2005\Nature and Extent of Contamination\Tanks_and_Excavations.mxd TtEMI-SF Kevin Ernst





Location Map

Storm Drain Line
Existing Stockpile
Removed Stockpile
Parcel D Boundary
Other Parcel Boundaries
Non-Navy Property
Building
Paved Surface
Unpaved Surface

Notes:

CAA Corrective action area
EE Exploratory excavation
RA Removal action
SPD Stockpile, Parcel D

N

400 0 400

Scale in Feet

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FIGURE 2-14

STOCKPILES AND STORM DRAIN LINES LOCATION MAP

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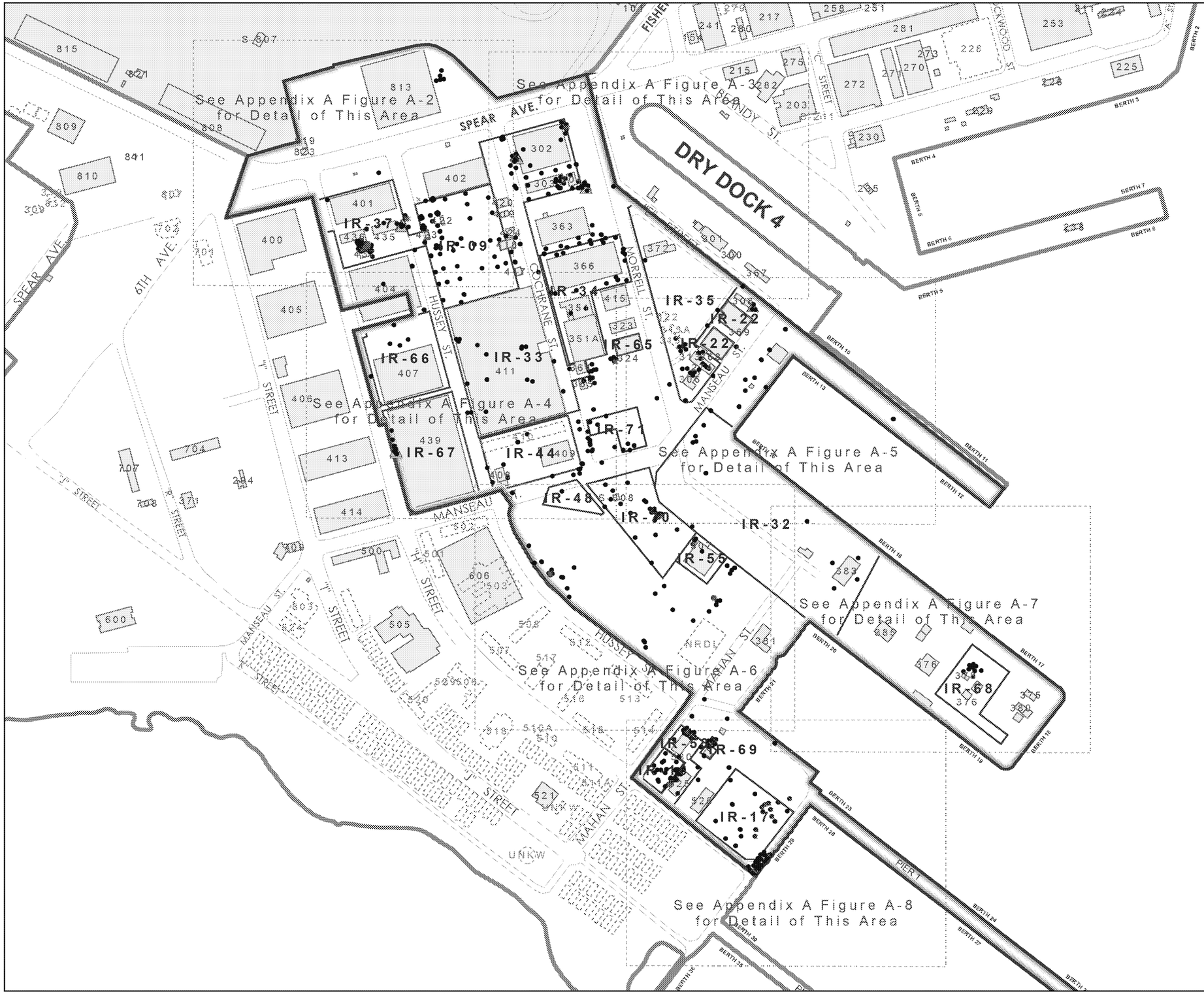
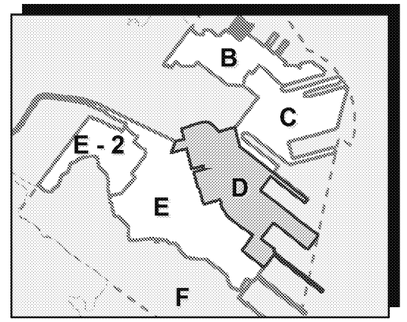
2007-10-15 V:\Hunters_Point\Projects\Parcel_D\FS_2005\Nature and Extent of Contamination\Stockpile_Locations.mxd TtEMI-SF Kevin Ernst





Location Map

Soil Sample Location

- Existing Sample
- Removed Sample
- Sample Location Map Extents

Former Underground Storage Tank Locations

- Removed
- Closed in Place
- Parcel D Boundary
- Other Parcel Boundaries
- IR Site Boundary
- Non-Navy Property
- Existing Building
- Demolished Building
- Road

Note:
IR Installation Restoration

N

400 0 400

Scale in Feet

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FIGURE 2-15

PARCEL D SOIL SAMPLE LOCATIONS

Revised Feasibility Study Report for Parcel D

2007-10-15 V:\Hunters_Point\Projects\Parcel_D\FS_2005\Nature and Extent of Contamination\Sample Location Maps\Soil Samples\Soil sample locations index map.mxd TtEMI-SF Kevin Ernst